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TRANSACTIONS

OF THE

FIFTH ANNUAL MEETING

OF THE

Kansas Academy of Science

(1872)

WITH REPORTS OF THE SECRETARY.

REPRINT, 1895.

Vol. I.

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ORGANIZATION AND HISTORY.

By John D. Parker, Secretary.

In a general sense science is restricted to what is certainly known. The boundaries have been well ascertained, the general features mapped out, and the territory is clearly defined. In a more specific sense, science observes the phenomena of things, produces in experiments results not ordinarily occurring in nature,—inducts facts, deduces truths, collects general principles, and arranges them in systematic order.

The scientific *method* of the present age is different from that of the past. The ancient logic is fruitless as a means for the discovery of truth. The inductive philosopher of the present age collects all the facts of his subject, classifies them into tables, expunges those that are not significant, gathers the vintage, scrutinizes with respect to true value and import, illustrates if practicable by actual experiment, discovers the laws of phenomena, and rises in his knowledge, from one generalization to another, until all the facts crystallize into one comprehensive system.

The scientific *spirit* of the present age simply inquires, "What is truth?" Truth is to be found at all hazards, and bought at any price. All known things are to be laid under contribution. New appliances are to be constructed, and new methods of analysis invented, until we stand, if possible, face to face with the absolute.

The scientific spirit of the present age is also liberal. Its faith is as large as the universe. All things are believed possible until proved impossible; all things are believed true until proved untrue. Nothing is to be rejected that stands the touchstone of observation, comparison and experiment.

The scientific spirit of the present age is also fearless. All truth must be consistent with itself. No two facts of the universe can contradict each other. No two laws of the universe can disprove

each other. Scientific men are, therefore, willing to follow whithersoever truth may lead them. The most venerable errors of the past, however cherished and embalmed in the human heart, are to be destroyed. The most sacred shrines of the old world are to be desecrated, the idols of the temple of science to be thrown down, and the foundations of the temple itself to be removed. Science lays its fearless hand even on revelation itself, and gives it a new interpretation.

The *results* of inductive scientific investigation are almost beyond belief. Our respected ancestors, only three or four centuries ago, were little better than barbarians. The darkness of that period is profound and painful. "Out of that darkness and chaos," says a recent writer, "have come all our civil and religious freedom, all our philanthropy and benevolence, all our diffused comfort and luxury, most of our good manners and morals, and all the splendid achievements of our modern scientific investigation." As the inductive philosopher seated himself before the chaff heaps of antiquity to winnow out the grains of truth, a mighty task was laid upon him. Every premise must be thoroughly established, every observation re-observed, every experiment reconducted, and every comparison recollected. Nothing less than a new creation lay before him. Well may the works of the great founder of the inductive philosophy be christened *Novum Organum* and *Instantatis Magna.*

Moved by the impulses of the age, a few naturalists in 1867 resolved if possible to effect an organization for the cultivation of science, particularly in its relation to the State of Kansas. Kansas occupies an important field in its scientific aspects. The scientific marvels of our age flow out of associated effort. Scientists need opportunity to compare results and effect exchanges. They need to be inspired to go forth into the fields of nature by the presence of other explorers.

After considerable correspondence among the naturalists of the State in reference to the possibility of effecting such an organization, a letter was published in the Kansas *Journal of Education* for March, 1868, calling attention to the benefits of such a society and the necessity of effecting an organization at an early day. The publication of this letter met with such favor and called forth so many responses from the friends of science throughout the State, that the following "call" was issued in July of the same year :

"STATE NATURAL HISTORY SOCIETY.

"We, the undersigned, desirous of securing the advantages arising from association in scientific pursuits, and of giving a more systematic direction to scientific

research in our State, do hereby invite all persons in the State interested in natural science to meet at Topeka on the first Tuesday of September next, at 3 P. M., at the college building, for the purpose of organizing a State Natural History Society.

JOHN FRASER,	G. F. CHAPIN,
D. H. ROBINSON,	J. H. CARRUTH,
B. F. MUDGE,	R. D. PARKER,
J. A. BANFIELD,	JEFF. ROBINSON,
J. S. HOUGHAM,	PETER MCVICAR,
J. D. PARKER,	F. H. SNOW,
R. A. BARKER,	J. S. WHITMAN,
D. BROCKWAY,	RICHARD CORDLEY,

J. R. SWALLOW."

Pursuant to this call, a meeting of the naturalists of the State was held in Lincoln College, Topeka, Kansas, September 1st, 1868. On mature deliberation and thorough discussion, an organization was effected under the name of the Kansas Natural History Society.

At the third annual meeting of the Society, held in the University building at Lawrence, on the 5th and 6th of September, 1870, President John Fraser suggested that the scope of the Society be enlarged to comprehend the whole field of science within the borders of the State.

On motion, Messrs. John Fraser, F. H. Snow, D. H. Robinson, Frederick W. Bardwell and John D. Parker, having been appointed a committee on enlargement of the scope of the Society, made the following report, which was adopted:

WHEREAS, The unexpected success of this young Society, as at present organized, has awakened in many the desire to have its scope enlarged so as to embrace in its membership observers and investigators in other lines of scientific inquiry; and,

WHEREAS, It appears to us that such a change in our organization is calculated to promote the interests of science, and thereby the higher interests of our State; therefore,

Resolved, That the name and scope of our Society be so changed as to include every line of scientific exploration and observation conducted by residents within our State.

At the fourth annual meeting, held in the rooms of the Board of Education at Leavenworth, on the 25th and 26th of October, 1871, the Constitution and By-Laws were so amended as to embrace in the membership of the Society observers and investigators in every line of scientific inquiry; and the name of the Society was changed from the Kansas Natural History Society to the Kansas Academy of Science.

PROCEEDINGS OF THE SOCIETY.

The first annual meeting of the Society was held in Lincoln College, Topeka, Kansas, September 1st, 1868. After mature deliberation and thorough discussion, the association was organized, and the following officers were elected for the current year:

B. F. Mudge, President; J. S. Whitman, Vice-President; John D. Parker, Secretary; Frank H. Snow, Treasurer; John A. Banfield, Curator.

The second annual meeting of the Society was held in the Presbyterian church, Topeka, Kansas, September 7th, 1869.

The following papers were read:

On the Internal Heat of the Globe, by B. F. Mudge.

On Solving the Higher Equations, by Edward Cave.

A public lecture was delivered on the Mound Builders, by John D. Parker.

The officers of the previous year were re-elected.

The third annual meeting of the Society was held in the University building, at Lawrence, on the 5th and 6th of September, 1870

The following papers were read:

On the Plants of Kansas, by James H. Carruth.

On the Fishes of the Kansas River, as observed at Lawrence, by Frank H Snow.

On the Internal heat of the Earth, by John D. Parker.

On the Comparison of the Coals of Kansas with other Western Coals, by Wm. H. Saunders.

On the Saurian Formation of Kansas, by B. F. Mudge.

On the Moss Agate Formation of Kansas, by B. F. Mudge.

The following public lectures were delivered:

On Aims, Organization and Advantages of Scientific Associations, by John Fraser.

On Hugh Miller, or the Workingman's Education, by John H. Barrows.

The following officers were elected for the current year:

John Fraser, President; B. F. Mudge, Vice-President; John D. Parker, Secretary and Librarian; Frank H. Snow, Treasurer; B. F. Mudge and Frank H. Snow, Curators.

The fourth annual meeting of the Society was held in the rooms of the Board of Education, at Leavenworth, on the 25th and 26th of October, 1871.

The following papers were read:

On the Plants of Kansas, (continued from last year) by James H. Carruth.

On the Birds of Kansas, by Frank H. Snow.

On the Burlington Gravel Beds, by John D. Parker.

On the Darwinian Theory, by John Wherrell.

On some rare forms of Crystallization of Gypsum, by B. F. Mudge.

On the Red Sandstone of Kansas, by B. F. Mudge.

The following public lectures were delivered:

On the claims of the Natural Sciences, by Frank H. Snow.

On the Geology of Kansas, by B. F. Mudge.

The following officers were elected:

John Fraser, President; B. F. Mudge and Robert J. Brown, Vice-Presidents; John D. Parker, Secretary; F. H. Snow, Treasurer; B. F. Mudge and F. H. Snow, Curators.

The fifth annual meeting of the Society was held in the Congregational church, at Manhattan, on the 8th and 9th of October, 1872.

The following papers were read:

On the Peculiarities of the Cherokee Language, by D. H. Robinson.

On Ventilation, by Colonel William Tweeddale.

On the Plants of Kansas, (continued from last year) by James H. Carruth.

On two varieties of Limestone from Junction City, by William H. Saunders.

On two varieties of Coal from Colorado, by William H. Saunders.

On the Birds of Kansas, (continued from last year) by Frank H. Snow.

On the Geology of the Arkansas Valley, by B. F. Mudge.

On the Relation of Light to the Quantity of Gas Consumed, by F. E. Stimpson.

On the Remoteness of the Final Catastrophe, by John D. Parker.

On what is Good for an Artist, and what an Artist is Good for, by Miss Lizzie J. Williams.

On the Sources of the English Language, by J. H. Lee.

On the National Park, by Joseph Savage.

A public lecture was delivered on the Agreement of the Bible with Geological Science, by Rev. Charles Reynolds, D. D.

The officers of the previous year were re-elected.

The following commissions were confirmed for the current year:

B. F. Mudge, Geology; F. H. Snow and Edwin A Popenoe, Entomology; D. H. Robinson and J. H. Lee, Language; F. W. Bardwell, Engineering; F. E. Stimpson, Physics; John Fraser, Astronomy; J. H. Carruth, Botany; John Wherrell, Mineralogy; William H Saunders, Chemistry; John D. Parker, Meteorology.

The next annual meeting of the Society will be held at Lawrence at the call of the Executive Committee.

CATALOGUE OF PLANTS SEEN IN KANSAS.

BY J. H. CARRUTH.

With additions by Prof. F. H. Snow and Prof. E. Hall.

It is with great reluctance that I present this catalogue of the plants of Kansas, because it is so incomplete, even for Douglas county. I hope, if spared, to add more names to it.

Kansas is out of the field of both Wood and Gray, and I find plants that are not in either of their books. I have then to resort to Eaton of forty years ago, or to send plants to some one who can enlighten me. I have several such cases now on hand. I find plants corresponding partially, but not entirely, to descriptions in the book, and then I am in doubt whether they are varieties, or distinct species not in the book.

Botanists seem not to have finished arranging species into their appropriate genera; consequently the same plant has different names in different books. I shall use the names in Wood's Botanist and Florist, presuming that they are according to the most recent decisions.

Botanists are not agreed, or, if they are, it is but recently, as to whether plants with certain marks are species or only varieties. In such cases, I shall give the name, and, perhaps, my opinion.

The botany of Kansas differs considerably from that of New England and New York. Having no peat bogs, we lack the side-saddle flower, and all plants peculiar to such places. Having but little sandy land, we have few plants peculiar to that kind of soil. So far as I know, the whole large order Ericaceæ, including the huckleberry, cranberry, checkerberry, spoon-wood, pinxter and rosebay, is entirely wanting.

The Coniferæ, including the pines, spruces and cedars have but one representative, the Red Cedar, and that is rare.

The Betulaceæ, including the birch and alder are wanting.

In the order Cupuliferæ, which includes the oak, the beech and the chestnut are wanting.

The splendid magnolia and tulip tree, common farther east and south, are not found here.

The large orders Malvaceæ, including the hollyhock; Cruciferæ, including cabbage and mustard; Orchidaceæ, including the wild Lady's Slipper; and Cyperaceæ, including sedges and other grass-like plants with triangular stems, have but few representatives.

Ferns, mosses and lichens, (such mosses, so called, as grow on rocks and rails,) are rare, and ground pines are wanting; fungi are not common, though I have seen specimens of the puff-ball family four or five inches in diameter.

On the other hand, the Leguminosæ, including the pea and clover; the Compositæ, including asters, golden rods and sunflowers; and the Gramineæ or grasses are well represented.

The plants in the following list which I have not seen, I give on the authority of Prof. F. H. Snow, of the Kansas State University, and Prof. E. Hall, of Athens, Illinois, who has made more than one journey through Kansas to observe its botany. And I would especially commend to the notice of those who have not seen it, a paper of his in the Report of the Department of Agriculture for 1870, on the grasses of the region between the Mississippi and the Rocky Mountains. It will interest the farmer as well as the botanist. For the list of ferns I am indebted to Mr. James Wilson, of Leavenworth. A few plants have been sent me by Prof. Mudge, of the Agricultural College. No doubt in the western part of Kansas, differing geologically from the eastern, and especially in the salt and gypsum regions, some peculiar plants will be found.

J. H. CARRUTH.

Plants not in Wood's Class Book nor Gray's Manual are marked thus, *. Those that are introduced or came themselves are marked thus, †.

CATALOGUE OF THE PLANTS OF KANSAS.

RANUNCULACEAE.

Clematis, Virgin's Bower.

C. verticillaris. Mrs. Craig of Franklin county. Rare.

C. Virginiana. Rare.

C. Viorna. Leather flower. Among bushes; not common.

Anemone, Windflower.

A. Caroliniana.

A. Virginiana.

A. Pennsylvaniea.

A. cylindrica.

Thalictrum, Meadow Rue.

T. Cornuti.

Ranunculus, Crowfoot.

R. multifidus.

R. oblongifolius.

R. abortivus.

R. repens. Snow.

Myosurus, Mousetail.

M. minimus. Rare.

Isopyrum, False Rue Anemone.

I. biternatum. Snow.

Aquilegia, Columbine.

A. Canadensis. Cliffs near Humboldt.

Delphinium, Larkspur.

D. tricorne. Wet grounds; common; flowers deep violet.

D. azureum, variety virescens. Flowers greenish white; common on prairies.

†D. Consolida. Snow.

ANONACEAE.

Asimina, Pawpaw.

A. triloba. Woods near streams.

MENISPERMACEAE.

Menispermum, Moonseed.

M. Canadense. Climbs bushes.

BERBERIDACEAE.

Podophyllum, May Apple, Mandrake.

P. peltatum. Common.

NYMPHÆACEAE.

Nelumbium, Water Bean.

N. luteum. Yonkopin (an Indian name). Ponds near streams, splendid.

PAPAVERACEAE.

Argemone, Prickly Poppy.

†A. Mexicana. Snow.

FUMARIACEAE.

Dicentra, Ear-drop.

D. cucullaria. Snow.

Corydalis, Corydalis.

C. aurea. Golden corydalis. Lawrence.

CRUCIFERAE.

Nasturtium, Water Cress.

N. tanacetifolium.

N. sinuatum.

N. palustre.

Iodanthus, False Rocket.

I. hesperidioides. Snow.

Arabis, Rock Cress.

A. dentata. Snow.

Sisymbrium.

S. officinale. Hedge mustard.

S. canescens. Tansy mustard. Snow.

Draba, Whitlow Grass.

D. cuneifolia. Snow.

Sinapis, Mustard.

S. nigra. Black Mustard.

Capsella, Shepherd's Purse.

†C. bursa-pastoris. Common.

Lepidium, Pepper Grass.

L. Virginicum.

L. ruderale. Common.

CAPPARIDACEAE.

Cleome, Spider Flower.

*C.——. Undetermined; sent from western Kansas by Professor Mudge. Pretty, but ill-scented.

Polanisia.

P. graveolens. Quarries, Lawrence.

VIOLACEÆ.

Viola, Violet.

V. delphinifolia. Common.

V. cucullata. Common.

V. pubescens.

HYPERICACEAE.

Hypericum, St. John's-wort.

H. corymbosum. Rare.

H. angulosum. Snow.

CARYCPHYLLACEAE.

Silene, Campion, Catchfly.

S. stellata. Common.

S. antirrhina. Snapdragon catchfly.

Cerastium, Mouse-ear Chickweed.

C. viscosum. Snow.

Mollugo, Carpet Weed.

†M. verticillaris. A common weed.

PORTULACACEAE

Portulaca, Purslane.

†P. oleracea. Too common.

Talinum.

*T. parviflorum. Snow.

Claytonia, Spring Beauty.

C. Virginica (?) (Possibly C. Caroliniana).

MALVACEÆ.

Malva, Mallows.

†M. rotundifolia.

Sida.

S. spinosa. Becoming troublesome in gardens.

Abutilon, Indian Mallows.

†A. Avicennæ. Roadsides. Said to be troublesome in Illinois.

Hibiscus.

H. Trionum. Flower-of-an-hour. Escaped from gardens.

H. militaris. Wet places. Resembles hollyhock.

TILIACEÆ.

Tilia, Linden.

T. Americana. Basswood. Not common.

LINACEÆ.

Linum, Flax.

L. sulcatum. Prairies. Scattered.

GERANIACEÆ.

Oxalis, Wood Sorrel.

O. violacea. Common.

O. stricta. Common.

Geranium, Crane's-bill.

G. Carolinianum.

Impatiens, Touch-me-not.

I. pallida.

RUTACEÆ.

Xanthoxylum, Prickly Ash.

X. Americanum.

ANACARDIACEÆ.

Rhus, Sumac.

R. glabra. Common.

R. copallina. Mountain Sumac.

R. Toxicodendron. Poison Ivy.

R. radicans. Climbing Ivy.

R. aromatica. Sweet Sumac.

SAPINDACEAE.

Acer, Maple.

A. dasycarpum. White maple. River banks.

A. saccharinum. Sugar maple. Linn county.

Negundo, Box Elder.

N. aceroides. Common.

Staphylea, Bladdernut.

S. trifolia. Occasional.

Æsculus, Buckeye.

Æ. glabra?

CELASTRACEAE.

Celastrus, Staff Tree.

C. scandens. Common.

Euonymus, Burning Bush.

E. atropurpureus.

RHAMNACEAE.

Ceanothus, Jersey Tea.

C. Americanus. Prairies.

C. ovalis.

Rhamnus, Buckthorn.

R. lanceolatus. Near streams.

VITACEAE.

V. æstivalis? Common. Leaves not rust-colored beneath; panicles loose, fruit tart, ripe in October.

V. cordifolia. Leaves dark green; panicle loose, fruit very small, tart, ripe in September.

V. riparia. Leaves light green; panicle compact, fruit pleasant, ripe July to September.

V. vulpina? One place. Leaves small, shining on both sides, most below, slightly lobed, teeth crenate, slightly mucronate.

V. indivisa. Fruit not eatable.

V. quinquefolia. Virginia creeper, common.

POLYGALACEAE.

Polygala, Milkwort.

P. incarnata. Prairies, scattered.

P. verticillata. Lawrence.

LEGUMINOSAE.

Schrankia, Sensitive Brier.

S. uncinata. Common.

Desmanthus.

D. brachylobus. Has a cluster of hooked pods.

Gymnocladus, Coffee Tree.

G. Canadensis. Frequent.

Gleditschia, Honey Locust.

G. triacanthos. Common.

Cassia, Senna.

C. chamæcrista. Sensitive pea. Common.

C. Marylandica. American senna. Occasional.

Cercis, Redbud.

C. Canadensis. Common.

Baptisia, Wild Indigo.

B. leucophæa. Common.

B. leucantha. Common.

B. australis. Snow.

Vicia, Vetch.

V. tetrasperma. Lawrence.

V. Americana.

V. Caroliniana. Snow.

Desmodium, Bush Trefoil.

D. nudiflorum.

D. acuminatum.

D. viridiflorum.

D. cuspidatum.

D. Canadense.

D. sessilifolium.

D. ciliare.

D. canescens.

D. paniculatum.

Lespedeza, Bush Clover.
L. capitata. Prairies; common.
L. violacea.
L. repens.

Crotalaria, Rattle Pod.
C. sagittalis.

Trifolium, Clover.
†T. repens. White clover.
†T. pratense. Red clover.
T. reflexum. Buffalo clover. Rare.
T. ———. One plant on bank of Wakarusa. At the time I made it T. carolinianum, but ? Flowers flesh-colored.

Melilotus.
†M. alba. Sweet clover. Gardens.

Psoralea.
P. floribunda. Prairies; common.
*P. argophylla. Prairies; scattered.
P. stipulata. Prairies; rare.
*P. esculenta. Prairies; not common. Has a root shaped like a turnip, one inch in diameter; eaten by Indians.

Amorpha, Lead Plant.
A. fruticosa. Prairies; common.
A. canescens. Prairies; common.

Dalea.
D. alopecuroides. Prairies; common.

Petalostemon.
P. candidum. Prairies; common.
P. violaceum. Prairies; common.

Astragalus, Milk Vetch.
A. Canadensis. Occasional.
A. caryocarpus. Prairie pea. Rocky places; common.
A. Mexicanus. Snow.

Tephrosia, Goat's Rue.
T. Virginica. Handsome. Indicates sand in the soil.

Robinia, Locust.
†R. pseudacacia. Yellow locust. Likes the country, but not the borers.

Apios, Ground Nut.
A. tuberosa. Wet places; tubers, several on a root; eatable when cooked.

Phaseolus, Kidney Bean.
P. diversifolius. Sandy places.
P. pauciflorus. Not common.

Amphicarpea, Pea Vine.
A. monoica. Bushes.
A Pitcheri ?

ROSACEAE.

Prnnus, Plum and Cherry.
P. Americana. Wild Plum. Common.
P. serotina. Black Cherry. Rare.

Rubus, Bramble.
R. villosus. High blackberry. Bushes, common.
R. Canadensis. Northern dewberry. Stony places; occasional.
R. occidentalis. Black raspberry. Bushes; common.

Geum, Avens.
G. album. Not rare.
G. Virginianum. Not rare.
G. ——— ? Root leaves polywoggy.

Fragaria, Strawberry.
F. Virginiana. Polygamous; the pistillate blossoms have small petals; common.

Potentilla, Cinquefoil.
P. Canadensis. Five-finger.
P. Norvegica.
P. paradoxa. Snow.

Rosa, Rose.
R. setigera. Prairie Rose. Bushes, fine, cultivated.
R. lucida. Prairies.
R. blanda. More common than the last. A variety of one of these has fruit conical, eight or ten together.

Agrimonia, Agrimony.
A. eupatoria.
A. parviflora.

Cratægus, Thorn.
C. tomentosa. Blackthorn. Common.
C. crus-galli. Cockspur thorn. Miami county.

Pyrus, Apple, Pear, etc.
P. coronaria. Wild Crab. Common.

SAXIFRAGACEAE.

Ribes, Currant, Gooseberry.
R. lacustre. Gooseberry, with prickly stems and bristly fruit; wet ground.
R. rotundifolium. A smooth gooseberry. woods; common.

CRASSULACEAE.

Sedum, Stone Crop.
S. pulchellum. Snow.

Penthorum, Virginia Stone Crop.
P. sedoides. Wet places.

LYTHRACEAE.

Lythrum, Loosestrife.
L. alatum. Damp; common.

Ammannia.
A. latifolia. Wet.

ONAGRACEAE.

Jussiæa.
J. repens. River mud.

Œnothera, Evening Primrose.
Œ. sinuata. Snow.
Œ. biennis. Common.
Œ. pumila.
Œ. linearis. Near Black Jack.
Œ. Missouriensis. Common; flower very large; fruit large, four-winged.
Œ. speciosa. Common; flowers change from white to red.

Gaura.
G. biennis. Common.
*G. linifolia. Common; pretty.
*G. mollis.

Ludwigia, Bastard Loosestrife.
L. alata. Wet.

Circæa, Enchanter's Nightshade.
C. lutetiana.

LOASACEAE.

Mentzelia.
M. oligosperma. Limestone quarries; leaves adhere to clothing.
*M. ornata. Flowers large and handsome, sent from western Kansas by Prof. Mudge.

CUCURBITACEAE.

Echinocystis, Balsam Apple.
E. lobata. Climbing, fruit prickly.

Sicyos, Single-seeded Cucumber.
S. angulata.

Cucumis, Cucumber.
*C. perennis. Gardens; tap root one inch in diameter twenty inches down; probably a native of the west.

CACTACEAE.

Opuntia, Prickly Pear.
O. vulgaris. Miami county.
O. Missouriensis. Hall.

Mamillaria.
M. vivipara. Hall.

UMBELLIFERAE.

Sanicula, Sanicle.
S. Canadensis. Wakarusa flats.

Eryngium.
E. yuccæfolium. Prairies; common; leaves broad-linear, parallel-veined.
E. Leavenworthii. Hall.

Polytænia.
P. Nuttallii. Hall.

Peucedanum, Dill, Parsnip.
*P. fœniculaceum. Stony places; common.
†P. sativum. Parsnip.

Osmorrhiza.
O. longistylis. Sweet Cicely. Miami county.
O. brevistylis. Near Clinton.

Chærophyllum, Chervil.
C. Tainturieri. Snow.

Carum, Caraway, etc.
C. aureum. Golden Alexanders.

Pimpinella, Anise, etc.
P. integrifolia. Seen once.

Apium, Celery, etc.
A. lineare. Wet.

CORNACEAE.

Cornus, Dogwood.
C. sericea. Common.
C. paniculata.

CAPRIFOLIACEAE.

Triosteum, Feverwort.
T. perfoliatum. Occasional.

Symphoricarpos, Snowberry.
S. vulgare. Frequent.

Sambucus, Elder.
S. Canadensis. Common.

Viburnum, Snowball, etc.
V. prunifolium. Black Haw.
V. Lentago. Sweet Viburnum. Snow.

RUBIACEAE.

Galium, Cleavers.
G. triflorum. Snow.
G. trifidum. Snow.
G. concinnum. Snow.
G. Aparine.

Houstonia, Bluets.
H. cærulea. Snow.
H. minima. Snow.
H. tenuifolia. Variety of H. longifolia.

Cephalanthus, Buttonbush.
C. occidentalis. Common.

COMPOSITÆ.

Vernonia, Ironweed.
V. fasciculata. Wet lands; glabrous.
V. ovalifolia. Common.
*V. Arkansana. Hall.

Liatris, Button Snakeroot, etc.
L. squarrosa. Blazing Star.
L. Boykinii. In sandy places.
L. scariosa. Gay Feather. Common.
L. pycnostachya.

Kuhnia.
K. eupatorioides. Common.

Eupatorium, Boneset.
E. purpureum.
E. altissimum.
E. perfoliatum. Boneset. Near Black Jack.
E. ageratoides.

Aster, Aster.
A. cordifolius.
A. Novæ-Angliæ.
A. Novi-Belgii.
A. Tradescanti. Snow.
A. multiflorus. Hall.
A. lævis.
A. oblongifolius.
A. azureus. Hall.
A. sericeus.
A. tenuifolius.
A. carneus.
A. ericoides. (Probably more.)

Erigeron, Fleabane.
E. Canadense. Hall.
E. divaricatum. Lawrence.
E. nudicaule. Lawrence.
E. bellidifolium. Common.
E. Philadelphicum. Common.
E. strigosum. Snow.

Boltonia.
B. glastifolia. Snow.

Solidago, Goldenrod.
S. squarrosa.

S. petiolaris.
S. puberula. Snow.
S. nemoralis. Common.
S. Missouriensis.
S. Canadensis.
S. stricta.
S. rigida. Common.
S. tenuifolia. Common.
*S. linifolia. Hall.

Chrysopsis.
C. villosa. Snow.

Eclipta.
E. alba. River mud.

Silphium, Rosinweed.
S. laciniatum. Polar plant; leaves north and south.
S. integrifolium.
S. perfoliatum. Cup plant; leaves make a cup; all common.

Parthenium.
P. integrifolium. Seen once.

Iva, Marsh Elder.
I. ciliata. Low, rich soil.

Ambrosia, Horseweed.
A. trifida. Rich soil.
A. artemisiæfolia. Hogweed. Roman Wormwood. Fields.
A. psilostachya. Hall. Prairies.

Xanthium, Clotbur.
X. strumarium. Troublesome.

Echinacea, Purple Coneflower.
E. purpurea ? Prairies.
E. angustifolia. Prairies.

Heliopsis, Ox-eye.
H. scabra. Variety of H. lævis; common.

Rudbeckia, Coneflower.
R. subtomentosa.
R. speciosa.

Lepachys.
L. pinnata. Lawrence.
*L. columnaris. Lawrence.

Helianthus, Sunflower.
H. rigidus.
H. giganteus.
*H. petiolaris. Common.
H. tomentosus.
H. grosse-serratus. Common.
H. mollis.
H. decapetalus.
H. doronicoides.
H. strumosus.
*H. orgyalis. South only.
*H. lenticularis. Hall.
*H. Maximiliani. Hall. And more.

Actinomeris.
A. squarrosa.

Coreopsis, Tickseed.
C. tinctoria. Hall.
C. delphinifolia.
C. palmata. Prairies.
C. aristosa. Scales linear, wavy; wet, [common.

Bidens, Bur Marigold.
B. frondosa. Beggar-ticks. Lawrence.
B. connata. Lawrence.
B. cernua. Lawrence.
B. chrysanthemoides.

Verbesina, Crown-beard.
V. Virginica. Wakarusa flats.

Grindelia.
*G. squarrosa *or* glutinosa. Lawrence.

Prionopsis.
*P. ciliata.

Dysodia, False Dog-fennel.
D. chrysanthemoides. Streets.

Helenium.
H. autumnale.
H. quadridentatum.

Anthemis, Chamomile, etc.
A. Cotula. Mayweed. Roads.

Amphyrachyris, Tumbleweed.
*A. dracunculoides. South. Hall.

Achillea, Yarrow.
A. millefolium. Common.

Tanacetum, Tansy.
†T. vulgare.

Artemisia, Wormwood.
A. Ludoviciana. Common.
A. vulgaris.
A. Canadensis.
*A. dracunculoides.

Gnaphalium, Everlasting.
G. polycephalum. Snow.

Antennaria.
A. plantaginifolia. Common.
*A. dioica. Hall.

Erechtites, Fireweed.
E. hieracifolius.

Cacalia, Tassel-flower.
C. tuberosa. Common.
C. atriplicifolia. Common.
C. reniformis. Snow.

Senecio, Groundsel.
S. aureus.

Cirsium, Thistle.
C. altissimum. Frequent.

Lappa, Burdock.
†L. officinalis. Came in 1865.

Hieracium, Hawkweed.
H. longipilum.

Nabalus, Drop-flower.
N. racemosus. Scattered.
N. asper. Scattered.

Troximon.
T. cuspidatum.

Taraxacum.
†T. dens-leonis. Came in 1866.

Lactuca, Lettuce.
L. elongata. Common.

Sonchus, Sow Thistle.
S. asper.

LOBELIACEÆ.

Lobelia.

L. cardinalis. Cardinal flower. Miami county.
L. syphilitica. Common.
L. leptostachys.

CAMPANULACEÆ.

Campanula, Bell-flower.

C. Americana.

Specularia, Venus's Looking-glass.

S. perfoliata. Common.
S. Ludoviciana. Snow.

EBENACEÆ.

Diospyros, Persimmon.

D. Virginiana. South; common.

PRIMULACEÆ.

Androsace.

A. occidentalis. Snow.

Lysimachia, Loosestrife.

L. hybrida. Common.
L. ciliata. Common.

PLANTAGINACEÆ.

Plantago, Plantain.

†P. major.
P. aristata, Rare.
P. gnaphalioides. Snow.
P. Virginica. Rare.

LENTIBULARIACEÆ.

Utricularia, Bladderwort.

U. vulgaris. Near Clinton.

OROBANCHACEÆ.

Aphyllon, Naked Broomrape.

A. uniflora. Snow.

BIGNONIACEÆ.

Martynia, Unicorn Plant.

†M. proboscidea. Escaped from gardens.

SCROPHULARIACEÆ.

Verbascum, Mullein.

†V. Thapsus. Occasional.
†V. Blattaria. Once.

Scrophularia, Figwort.

S. nodosa.

Pentstemon, Beard-tongue.

P. digitalis.
*P. Cobœa. Rocks; common.
P. tubiflorus. Snow.

Mimulus, Monkey-flower.

M. ringens. Snow.
M. alatus. Common.

Herpestis.

H. rotundifolia. Water; flowers white; curious.

Ilysanthes.

I. gratioloides. Snow.

Veronica, Speedwell.

V. Virginica.
V. peregrina. Snow.

Buchnera, Bluehearts.

B. Americana. Near Black Jack.

Seymeria.

S. macrophylla. Near Baldwin.

Gerardia.

G. auriculata.
G. tenuifolia.
G. asperifolia. Hall.

Pedicularis, Lousewort.

P. Canadense.

ACANTHACEAE.

Ruellia.

R. strepens.
R. ciliosa. Common.

Dianthera.

D. Americana. Near Clinton.

VERBENACEAE.

Verbena, Vervain.

V. angustifolia.
V. hastata. Streets; common.
V. urticæfolia. Streets; common.
V. stricta. Streets; common.
V. bracteosa.
V. Aubletia. Rocks; common.

Lippia, Fog-fruit.

L. nodiflora.

Phryma, Lopseed.

Ph. leptostachya.

LABIATAE.

Teucrium, Germander.

T. Canadense. Common.

Isanthus, False Pennyroyal.

I. cæruleus.

Mentha, Mint.

M. arvensis.
M. Canadensis.

Lycopus, Water Horehound.

L. Europæus. Common.

Hedeoma, American Pennyroyal.

H. hispida. Lawrence.

Pycnanthemum, Basil.

P. lanceolatum.
P. linifolium.
P. pilosum.

Salvia, Sage.

*S. Pitcheri. Prairies; common.
*S. trichostemmoides. Roads.

Monarda, Mountain Mint.

M. fistulosa (whistulosa?). Common.

Blephilia.

B. hirsuta. Near Baldwin.
B. ciliata. Near Baldwin.

Lophanthus, Hedge Hyssop.

L. nepetoides. Near Baldwin.

Nepeta, Catmint.
†N. cataria.
†N. glechoma. Snow.

Brunella, Self-heal.
B. vulgaris. Common.

Scutellaria, Skullcap.
S. parvula.

Physostegia, Lion-heart.
P. Virginiana. Wet, pretty.

Stachys, Hedge Nettle.
S. glabra.

Leonurus, Motherwort.
†L. cardiacus.

Marrubium, Horehound.
†M. vulgare.

BORAGINACEÆ.

Onosmodium.
O. Virginianum. Common.
O. Carolinianum. Near Clinton.
O. molle. Snow.

Lithospermum, Gromwell.
L. angustifolium.
L. canescens. Puccoon. Common.
L. longiflorum. South of Baldwin.
L. hirtum. Snow.

Cynoglossum, Hound's Tongue.
†C. officinale.
C. Morrisoni. Beggar-ticks.

HYDROPHYLLACEÆ.

Hydrophyllum, Waterleaf.
H. Virginicum.

Ellisia.
E. Nyctelea. Along streams.

POLEMONIACEÆ.

Phlox, Lychnidea.
P. pilosa. Prairies. Common.
P. divaricata, variety Laphami. Woods

CONVOLVULACEÆ.

Pharbitis, Morning Glory.
†P. purpurea. Purple.
†P. Nil. Blue. Both tenacious as weeds.

Ipomœa.
I. lacunosa.
I. pandurata. Wild potato.

Calystegia.
C. spithamæa. Snow.
C. Sepium. Rutland Beauty. Troublesome.

Cuscuta, Dodder.
C. glomerata. Common.
C. compacta, variety appressa. Snow.
C. chlorocarpa. Lawrence.
C. decora. Snow.

SOLANACEÆ.

Solanum, Potato, etc.
S. nigrum. Nightshade. Gardens.
S. carolinense. Horse Nettle. Fields.
*†S. rostratum. Waste grounds. Came in 1864.

Physalis, Ground Cherry.
I have had six forms (species?) not including P. Philadelphica, which I know, growing in my garden the past year, all but the first spontaneous. Of the first two I have often seen the seed-leaves; the last four I have traced to old roots. None of them have "anthers purple," but the four that have "corolla spotted" have the fleshy filaments violet or purple. All but the P. lanceolata grow as they please, not regarding the descriptions in the books. I guess at four. The last seems not in the books. I give only some points, not full descriptions.

P. viscosa (?) Annual; not viscid; brownish green; pedicels half inch; corolla four lines broad; fruit calyx roundish, five-angled; fruit eatable.

P. nyctaginea (?) Annual; clammy; odorous, strong as the tomato; light green; leaves one to two inches long; pedicels half inch; corolla not spotted, three lines broad: fruit calyx roundish, ten-angled.

P. Pennsylvanica (?) Perennial; glabrous, erect, two feet high, branching above, simulating a walnut tree; leaves single; pedicels one inch; corolla spotted, eight or ten lines; fruit calyx truncate at base, cylindric-conic, or with ten or twenty angles.

P. lanceolata. Perennial, eight inches high, decumbent, bush-like; leaves in pairs; corolla spotted, ten lines; fruit calyx like a junk-bottle.

P. pubescens (?) Perennial; low, broad, very pubescent; pedicels long, oval, pointed.

*P. ———. Perennial; low, bushy, decumbent; leaves rhombic-oval, entire; pedicels nearly two inches: corolla not spotted; fruit calyx large, oval, five-angled.

Datura, Thorn-apple, Jimson-weed.
D. Stramonium. Waste ground.

GENTIANACEÆ.

Gentiana, Gentian.
G. alba.
G. puberula. Snow.
G. Saponaria.
G. Andrewsii. Snow.

APOCYNACEÆ.

Apocynum, Dogbane.
A. cannabinum. Common.

ASCLEPIADACEÆ.

Asclepias, Milkweed.
A. Cornuti.
A. purpurascens.
A. obtusifolia.
A. incarnata.
A. tuberosa. Common.
A. verticillata.
A. Meadii. Snow.
*A. obovata (?)

Acerates.
A. viridiflora.
A. longifolia.
A. monocephala. Snow.
A. paniculata. Common.
*A. angustifolia.

OLEACEÆ.

Fraxinus, Ash.

F. Americana. White Ash. Rare.
F. viridis. Green Ash. Common.

ARISTOLOCHIACEÆ.

Asarum, Wild Ginger.

A. Canadense.

NYCTAGINACEÆ.

Oxybaphus.

O. nyctagineus.
O. angustifolius.
O. linearis.
O. albidus. Snow.

POLYGONACEÆ.

Rumex, Dock.

R. crispus. Yellow Dock.
R. altissimus. Peach-leafed Dock.
†R. acetosella. Snow.

Polygonum, Knotgrass, etc.

†P. aviculare.
†P. erectum. Said to be a variety of the preceding. Growing together they appear distinct and not graduating into each other.
P. tenue.
P. ramosissimum.
P. hydropiperoides. Mild Water-pepper.
P. acre. Smartweed.
P. hydropiper. Water Pepper.
P. Persicaria. Lady's Thumb.
P. Pennsylvanicum.
P. incarnatum.
P. amphibium.
P. Virginianum.
P. Convolvulus. Knot Bindweed. Fields.
P. dumetorum. Hedge Bindweed. Climbs bushes ten feet.

PHYTOLACCACEÆ.

Phytolacca, Poke.

P. decandra.

CHENOPODIACEÆ.

Chenopodium, Pigweed, etc.

C. album. Common Pigweed.
C. hybridum.
C. ambrosioides.

Cycloloma.

C. platyphyllum. River banks.

AMARANTACEÆ.

Amarantus, Amaranth.

A. paniculatus.
A. sanguineus. Blood-red variety of the preceding.
A. retroflexus.
A. hybridus.
A. chlorostachys.
A. albus. All garden weeds.

Amblogyne.

*A. Torreyi. A diœcious garden weed. I had one seven feet high and eleven feet in diameter.

SANTALACEÆ.

Comandra, Bastard Toad-flax.

C. umbellata. Snow.

EUPHORBIACEÆ.

Euphorbia.

E. marginata. Handsome.
E. corollata. Prairies. Common.
E. Curtisii.
E. heterophylla.
E. dentata.
E. hypericifolia.
E. humistrata.
E. cordifolia.
E. maculata.
E. serpens.
*E. hexagona.

Tragia.

T. urticæfolia. Lawrence.

Acalypha, Three-seeded Mercury.

A. Virginica. Lawrence.

Croton.

C. monanthogynus.
C. capitatus. Roads.

URTICACEAE.

Ulmus, Elm.

U. Americana. White Elm. Common.
U. fulva. Slippery Elm. Common.

Celtis, Hackberry.

C. occidentalis. Common.

Maclura, Osage Orange.

†M. aurantiaca. Hedges.

Morus, Mulberry.

M. rubra.

Urtica. Nettle.

U. dioica (?)
U. urens.

Laportea, Wood Nettle.

L. Canadensis.

Pilea, Richweed.

P. pumila.

Humulus, Hop.

H. lupulus. Occasional.

Cannabis, Hemp.

†C. sativa. Escaped.

PLATANACEAE.

Platanus, Buttonwood.

P. occidentalis.

JUGLANDACEAE.

Juglans, Walnut.

J. nigra. Black Walnut.

Carya, Hickory.

C. olivæformis. Pecan. Common south.
C. amara. Bitternut. Hall.
C. alba. Shagbark. Common.
C. sulcata. Shellbark. Bottoms.
C. porcina. Pignut. Common.

CUPULIFERAE.

Quercus, Oak.

Q. imbricaria. Shingle Oak. Clinton.
Q. laurifolia. Swamp Laurel Oak. Near Kansas City.
Q. nigra. Black Jack. Sandy land.
Q. rubra. Red Oak. Common.
Q. palustris. Pin Oak. Wet; south.

Q. tinctoria. Yellow bark Oak. Lawrence. Snow.
Q. coccinea. Scarlet Oak. Common.
Q. alba. White Oak. Near Baldwin.
Q. macrocarpa. Bur Oak. River bottoms.
Q. obtusiloba. Post Oak. Rocky land.
Q. prinus. Swamp Chestnut Oak. Common.
Q. bicolor. Swamp White Oak. Common.
Q. castanea. Chestnut Oak.
Q. prinoides. Dwarf Chestnut Oak.
*Q. lyrata (?) Acorn almost covered; near Tonganoxie.
*Q. ——— Shrub; leaves sessile, cordate, full, so as to fold in pressing; lobes sharply three angled.
*Q. ——— Leaves cruciform, lobes three angled, scales of cup with points.

Corylus, Hazel.
C. Americana. Common.

SALICACEÆ.

Salix, Willow.
S. tristis.
S. humilis. Snow.
S. discolor.
S. longifolia.
S. nigra.
S. cordata.
S. myricacea.
*S. ——— (?) Young branches densely tomentose, drab.

Populus, Poplar.
P. monilifera. Cottonwood. Streams.

CONIFERÆ.

Juniperus, Juniper.
J. Virginiana. Red Cedar. Rare.

ARACEÆ.

Arisæma, Indian Turnip.
A. triphyllum. Jack in the pulpit.
A. dracontium. Green dragon.

LEMNACEÆ.

Lemna, Duckmeat.
L. perpusilla.

TYPHACEÆ.

Typha, Cat-tail.
T. latifolia.

Sparganium, Bur Reed.
S. eurycarpum. Near Clinton.

NAIADACEÆ.

Potamogeton, Pondweed.
P. ——— Undetermined.

ALISMACEÆ.

Alisma, Water Plantain.
A. Plantago.

Sagittaria, Arrowhead.
S. variabilis. Common.

ORCHIDACEÆ.

Cypripedium, Lady's Slipper.
C. parviflorum. Snow.

Orchis, Orchis.
O. leucophea. White prairie O. Rare.

Spiranthes, Lady's Tresses.
S. gracilis. Miami county.
S. cernua. Near Clinton.

AMARYLLIDACEÆ.

Hypoxis, Stargrass.
H. erecta. Common.

IRIDACEÆ.

Iris, Flower-de-Luce.
I. versicolor. Snow.

Sisyrinchium, Blue-eyed Grass.
S. Bermudianum. Common.

SMILACEÆ.

Smilax, Green-brier.
S. rotundifolia. Common.
S. peduncularis. Near Clinton.

LILIACEÆ.

Erythronium.
E. albidum. Prairies; very early.

Lilium, Lily.
L. Carolinianum. Rare.

Scilla, Squill.
S. esculenta. Quamash. Has a bulb at base of stem; common.

Allium, Onion.
A. mutabile. Wet; common.
A. striatum. Wet; more common.
A. Canadense. Snow.

Polygonatum, True Solomon's Seal.
P. biflorum.
P. giganteum. Snow.

Smilacina, Solomon's Seal.
S. stellata.

MELANTHACEAE.

Melanthium.
M. Virginicum. Wet; occasional.

PONTEDERIACEAE.

Heteranthera.
*H. callæfolia (?) It has ten to twelve blue flowers, about half of them inclosed in the spathe; near Eudora.
H. limosa. Same place.

COMMELYNACEAE.

Commelyna, Day-Flower.
C. Virginica. Curious; near Clinton.

Tradescantia, Spiderwort.
T. Virginica. Prairies; common.
T. pilosa. Snow.

CYPERACEAE.

Cyperus, Galingale.
C. filiculmis (?)
C. strigosus.

Eleocharis, Spiked Rush.
E. intermedia.

Scirpus, Bulrush.
S. divaricatus.
S. validus. Common Bulrush.
S. atrovirens.

Eriophorum, Cotton Grass.
E. —— Not determined.

Carex, Sedge.
C. lenticularis.

GRAMINEAE, GRASSES.

Leersia, Cut Grass.
L. Virginica. Along rivulets, Lawrence.

Zizania, Wild Rice.
Z. aquatica, Twelve feet high; near Osawatomie.

Agrostis, Bent Grass.
A. scabra. Rough Hair Grass.

Sporobolus, Drop-seed Grass.
S. vaginæflorus. Hall says it is worthless, but about Lawrence, cattle feed it close, and it is about the only grass that stands feeding.
S. heterolepis. Hall. Hall says it is valuable and common south and west.
S. asper. Sand near Lawrence.
*S. cuspidatus. Hall.
*S. depauperatus. Hall.

Muhlenbergia, Dropseed Grass.
M. Mexicana.

Stipa, Feather Grass.
S. juncea. Weather Grass. Awns very long; base of seed bearded; ripe in June.

Paspalum.
P. setaceum. Curious; Lawrence. Hall says the only species west of the Mississippi.

Panicum, Panic Grass.
P. capillare. Common.
P. filiforme. Stools abundantly.
P. amarum.
P. virgatum. Common.
P. villosum. Pedicels flexuous.
P. dichotomum. Hall.
P. pauciflorum. Hall.

Oplismenus, Cockspur Grass.
O. crus-galli, variety muticus. Common.

Setaria, Bristly Fox-tail.
S. glauca. Bottle Grass. Everywhere.
S. viridis. Wild Timothy. Rare.

Cenchrus, Bur Grass.
C. tribuloides. Burs stick to clothes.

Phalaris, Canary Grass.
P. arundinacea.

Tricuspis.
T. seslerioides. False Red-top.

Kœleria.
K. cristata.

Diarrhena.
D. Americana. Bottoms; leaves broad; green in winter.

Eragrostis.
E. poæoides. Odorous; common.
E. pilosa.
E. tenuis. Pretty; panicle near two feet long.
E. capillaris. Hall.
E. pectinacea.

Poa, Spear Grass.
P. annua. Sent from the Arkansas by Professor Mudge.
†P. pratensis. Kentucky Blue Grass.

Uniola, Union Grass.
U. latifolia. Among the bushes; pretty.

Phragmites, Reed.
P. communis. Water; eleven feet high; near the Wakarusa.

Lepturus.
L. paniculatus. Looks like a branching wire.

Hordeum, Barley.
H. pusillum.

Elymus, Rye Grass.
E. Virginicus.
E. Canadensis.
E. Hystrix. Hedge-hog Grass; woods.

Leptochloa.
L. fascicularis.
Cynodon, Bermuda Grass, Crab Grass.
C. dactylon. Five fingers; a bad weed.

Spartina, Cord Grass.
S. cynosuroides. Wet; tall; tough; poor fodder; spikes one-sided.

Bouteloua.
B. curtipendula. Spikelets hang from the lower side.
B. obligostachya. Low; one-sided spikes at right angles; all on one side.

Tripsacum, Sesame Grass.
T. dactyloides. Tall; staminate flowers above the pistillate.

Andropogon.
A. furcatus. Forked stem; blue stem.
A. scoparius. Broom Grass.

Sorghum.
S. nutans. Wood Grass. Hall thinks the last three make eighty per cent. of the prairie grasses; they do not bloom every year.

EQUISETACEAE.

Equisetum, Horse-tail.

E. sylvaticum.
E. pratense. Snow.
E. hyemale. Scouring Rush. Snow.

FILICES, FERNS.

In the order given by Mr. Wilson. They were all found in Leavenworth county.

Adiantum, Maiden-hair.

A. pedatum Linn. Shady woods; abundant; this I have often seen.

Onoclea, Sensitive Fern.

O. sensibilis Linn. Shady thickets; common.

Woodsia, Rock Polypod.

W. obtusa Torrey. Calcareous rocks near Fort Leavenworth.

Cystopteris, Bladder Fern.

C. fragilis Bernh. Moist woods; abundant.

Aspidium, Shield Fern.

A. Goldianum Hook. Goldie's Fern. Shady woods; not frequent.

Asplenium, Spleenwort.

A. angustifolium Michx. Bank of Missouri; several places.

Botrychium, Rattlesnake Fern.

B. Virginicum Linn. Dry woods; hazel brush; common.

Allosorus, Rock Brake.

A. atropurpureus Gray. (Pteris, Linn.) Dry rocks; river bank; rare.

Camptosorus, Walking Fern.

C. rhizophyllus Link. Antigramma, J. Smith. Mossy rocks; river bank; rare.

Number of species, about 540.

Not east of the Mississippi, (?) 36.

Further observation may show some errors.

CATALOGUE OF THE BIRDS OF KANSAS.

BY PROF. FRANK H. SNOW, OF KANSAS UNIVERSITY.

The following list of birds is based upon the personal observations of the author during a residence of six years in Kansas. Valuable assistance has been rendered by a few friends of ornithology in Kansas, among whom special mention should be made of Edwin A. Popenoe, of Topeka, and Geo. F. Gaumer and Nelson J. Stephens, of Lawrence. Acknowledgments are also due to T. M. Brewer, M.D., of Boston, for important additions. The notes in quotation marks were furnished by him. The list already contains two hundred and eighty-two species, representing thirty-nine families, and is being constantly enlarged. The entire number of species will undoubtedly reach three hundred. In this catalogue, one hundred and twenty-seven birds known to breed in Kansas are marked with an asterisk (*).

This edition contains important additions by Prof. S. F. Baird, of the Smithsonian Institution, and Prof. J. A. Allen, of the Museum of Comparative Zoology, at Cambridge, whose names are appended to their respective contributions. The author is also indebted to these gentlemen for valuable notes upon some of the birds enumerated.

VULTURIDAE—VULTURES.

1.* Cathartes aura. Turkey Buzzard. Common, and comparatively tame, approaching quite near to farm houses and towns.

FALCONIDAE—HAWKS AND EAGLES.

2.* Falco anatum. Duck Hawk. Not common. Found breeding near Fort Hays, by J. A. Allen.

3. Hypotriorchis columbarius. Pigeon Hawk. Common.

4. Hypotriorchis Richardsonii. Richardson's Merlin. Baird.

5. Falco polyagrus. Prairie Falcon. Rare in winter.

6.* Tinnunculus sparverius. Sparrow Hawk. Very common.

7. Astur atricapillus. The Goshawk. Not common. A fine adult specimen in the collection of Dr. W. H. Saunders, of Lawrence.

8. Accipiter Cooperii. Cooper's Hawk. Not common.

9. Accipiter fuscus. Sharp-shinned Hawk. Occasional.

10. Buteo Swainsonii. Swainson's Hawk. Two undoubted specimens of this "far western" bird are in my collection. They were collected within five miles of Lawrence.

10a. Buteo insignatus. Brown Hawk. Now considered to be the same as the preceding.

11. Buteo Harlani. Black Warrior. A pair of these rare birds appeared within one mile of Lawrence, in October, 1871. The male, an adult, was captured by Nelson J. Stephens, in a plumage not seen before.

12.* Buteo borealis. Red tailed Hawk. Common in timber.

12a. Buteo montanus. Western Red-tail. A single specimen was taken in December, 1871, by William Osburn, of Lawrence. Generally considered to be the same species as the preceding.

13.* Buteo lineatus. Red-shouldered Hawk. Rare at Lawrence.
14. Buteo Pennsylvanicus. Broad-winged Hawk. Not common. Taken by E. U. Prentice of Topeka.
15. Archibuteo lagopus. Rough-legged Hawk. Abundant in winter.
16.* Nauclerus furcatus. Swallow-tailed Hawk. Rare. A pair taken in July, 1870, near Lawrence, by N. Deming.
17. Ictinia Mississippiensis. Mississippi Kite. Baird.
18.* Circus Hudsonius. Marsh Hawk. Abundant.
19. Aquila Canadensis. Golden Eagle. A fine specimen of this noble bird was captured alive seventeen miles from Lawrence, in January, 1869, and was kept in confinement by the writer for nearly two years. It is now in the collection of mounted specimens belonging to the University.
20.* Haliaetus leucocephalus. Bald Eagle. Not rare.
21. Pandion Carolinensis. Fish Hawk. Uncommon.

STRIGIDAE — OWLS.

22.* Strix pratincola. Barn Owl. Rare.
23.* Bubo Virginianus. Great Horned Owl. Not uncommon.
24.* Scops asio. Screech Owl. Abundant.
25. Otus Wilsonianus. Long-eared Owl. Quite common.
26. Brachyotus Cassinii. Short-eared owl. Common on the prairie in autumn and winter.
27. Syrnium nebulosum. Barred Owl. Common.
28. Nyctale Acadica. Saw-whet Owl. Rare.
29.* Athene hypogæa. Burrowing Owl. Abundant on the plains of Western Kansas.
30. Nyctea nivea. Snowy Owl. Rare in winter.

PSITTACIDAE — PARROTS.

31. Conurus Carolinensis. Parakeet, Carolina Parrot. Formerly abundant in the woods of Eastern Kansas; now seen occasionally in districts thinly settled.

CUCULIDAE — CUCKOOS.

32.* Coccygus Americanus. Yellow-billed Cuckoo. Quite common.
33.* Coccygus erythrophthalmus. Black-billed Cuckoo. Rare at Lawrence. Found breeding near Leavenworth, by Prof. John Wherrell, in 1872.

PICIDAE — WOODPECKERS.

34.* Picus villosus. Hairy Woodpecker. Common.
35.* Picus pubescens. Downy Woodpecker. Abundant.
36. Sphyrapicus varius. Yellow-bellied Woodpecker. "Taken in Kansas several times."
37.* Hylotomus pileatus. Black Wood Cock. Rare.
38.* Centurus Carolinus. Red-bellied Woodpecker. Abundant.
39.* Melanerpes erythrocephalus. Red-headed Woodpecker. Abundant. Not shunning man as in the Eastern States, but frequenting the cities and towns, as if domesticated.
40.* Colaptes auratus. Golden-winged Woodpecker. Often seen in the towns, but less bold than the last species.
40a. Colaptes hybridus. Hybrid Woodpecker. A mounted specimen is in the collection of Mr. O. S. George, of Topeka. Taken also at Lawrence in October, 1872.
41. Colaptes Mexicanus. Red-shafted Woodpecker. Taken in December, 1872, by Nelson J. Stephens, from a flock which remained for two or three weeks in the timber within two miles of Lawrence.

TROCHILIDAE — HUMMING BIRDS.

42.* Trochilus colubris. Ruby-throated Humming Bird. Common.

CYPSELIDAE — SWIFTS.

43.* Chætura pelasgia. Chimney Swallow. Once rare; becoming common.

CAPRIMULGIDAE — GOAT-SUCKERS.

44.* Antrostomus vociferus. Whippoorwill. Rare.
45.* Antrostomus Nuttallii. Poorwill. Allen. At Topeka. Common at localities in Eastern and Middle Kansas.
46.* Chordeiles popetue. Night-hawk. Common.
47. Chordeiles Henryi. Western Night-hawk. Allen. Near Fort Hays.

ALCEDINIDAE — KINGFISHERS.

48.* Ceryle alcyon. Belted Kingfisher. Common.

COLEOPTERIDAE — FLYCATCHERS.

49. Milvulus forficatus. Scissor-tail. Baird. Taken at Fort Riley by Dr. Coues.
50.* Tyrannus Carolinensis. King-bird, Bee-bird. Common.
51.* Tyrannus verticalis. Arkansas Flycatcher. "Western Kansas." Abundant also in Eastern Kansas.
52.* Myiarchus crinitus. Great Crested Flycatcher. Common; often seen in the towns.
53.* Sayornis fuscus. Phœbe Bird. Nests under bridges; common.
54. Contopus borealis. Olive-sided Flycatcher. "Passes through as a migrant."
55. Contopus Richardsonii. Short-legged Pewee.
56. Contopus virens. Wood Pewee. Probably breeds in Kansas.
57. Empidonax Traillii. Traill's Flycatcher. Probably breeds in Kansas.
58. Empidonax pusillus. Little Flycatcher.
59. Empidonax minimus. Least Flycatcher. Probably breeds in Kansas.
60. Empidonax flaviventris. Yellow-bellied Flycatcher. "Passes through in migration."
61.* Empidonax Acadicus. Small Green-crested Flycatcher. Eastern Kansas. Allen.

TURDIDAE — THRUSHES.

62.* Turdus mustelinus. Wood Thrush. Common in the timber.
63. Turdus Pallasii. Hermit Thrush. Baird. One specimen taken at Topeka, by J. A. Allen.
64. Turdus fuscescens. Wilson's Thrush. "Passes through in migration."
65. Turdus Swainsoni. Olive-backed Thrush. "Passes through in migration."
66.* Turdus migratorius. American Robin. Once rare, but becoming more common every year. Remains through the winter.
67.* Sialia sialis. Bluebird. Common. Remains through the winter.
68. Regulus calendula. Ruby-crowned Wren. Spring and fall. Stragglers seen in the breeding season at Lawrence in 1871.
69. Regulus satrapa. Golden-crested Wren. "Passes through in migration."

SYLVICOLIDAE — WARBLERS.

70. Anthus Ludovicianus. Titlark. Usually quite common in spring, and sometimes in fall; frequents ploughed fields and prairies.
71.* Mniotilta varia. Black and White Creeper. Common.
72. Parula Americana. Blue Yellow-back. Allen. Near Leavenworth.
73.* Protonotaria citrea. Prothonotary Warbler. "Found breeding at Neosho Falls."
74.* Geothlypis trichas. Maryland Yellow-throat.
75. Geothlypis Philadelphica. Mourning Warbler. Allen. One specimen taken at Topeka.
76.* Oporornis formosus. Kentucky Warbler. Common.
77.* Icteria viridis. Yellow-breasted Chat. Common.
78.* Helminthophaga pinus. Blue-winged Yellow Warbler. Allen. Near Leavenworth. Common in Eastern Kansas.

79. Helminthophaga chrysoptera. Golden-winged Warbler. Baird.
80. Helminthophaga ruficapilla. Nashville Warbler. Allen. Near Leavenworth.
81. Helminthophaga celata. Orange-crowned Warbler. "Passes through in migration."
82. Helminthophaga peregrina. Tennessee Warbler. "Passes through in migration."
83.* Seiurus aurocapillus. Oven-bird; Golden-crowned Thrush. Common.
84. Seiurus noveboracensis. Small-billed Water Thrush. Baird.
85.* Seiurus Ludovicianus. Large-billed Water Thrush.
86. Dendrœca virens. Black-throated Green Warbler. Baird.
87. Dendrœca cærulescens. Black-throated Blue Warbler. Baird.
88. Dendrœca coronata. Yellow-rump Warbler. Common in spring.
89. Dendrœca Blackburniæ. Blackburnian Warbler. Allen. Near Leavenworth.
90. Dendrœca Pennsylvanica. Chestnut-sided Warbler. "Passes through in migration."
91.* Dendrœca cærulea. Blue Warbler. Allen. Near Leavenworth.
92.* Dendrœca æstiva. Yellow-poll Warbler. Common.
93. Dendrœca superciliosa. Yellow-throated Warbler. "Probably breeds in Kansas. Seen in June at Neosho Falls."
94.* Dendrœca discolor. Prairie Warbler. Allen. Common in Eastern Kansas.
95.* Myiodioctes mitratus. Hooded Warbler. Allen. Near Leavenworth.
96. Myiodioctes pusillus. Green Black-Cap Flycatcher. "Migratory."
97.* Setophaga ruticilla. Red-start. Common.
98.* Pyranga rubra. Scarlet Tanager. Common in the timber.
99.* Pyranga æstiva. Summer Red-bird. Baird.

HIRUNDINIDAE — SWALLOWS.

100.* Hirundo horreorum. Barn Swallow. Seen at Leavenworth by T. M. Brewer, M.D.
101.* Hirundo lunifrons. Cliff Swallow. Common.
102.* Hirundo bicolor. White-bellied Swallow. Not so common as in the Eastern States.
103.* Cotyle riparia. Bank Swallow. Common.
104.* Cotyle serripennis. Rough-winged Swallow. Common.
105.* Progne purpurea. Purple Martin. Common.

BOMBYCILLIDAE — WAXWINGS.

106.* Ampelis cedrorum. Cedar Bird. Rare. More frequent in 1872.

LANIIDAE — SHRIKES.

107. Collurio borealis. Butcher Bird. Common in winter.
108. Collurio Ludovicianus. Loggerhead Shrike. Three specimens taken in January and February, 1871. Breeds in the Southern States. Taken also in March, 1873.
109.* Collurio excubitoroides. White-rumped Shrike. Abundant.
110.* Vireo olivaceus. Red-eyed Flycatcher. Common.
111.* Vireo gilvus. Warbling Flycatcher. Reported breeding, by J. A. Allen.
112.* Vireo Bellii. Bell's Vireo. Quite common.
113.* Vireo noveboracensis. White-eyed Vireo. Baird. Taken at Lawrence in June, 1872.
114. Vireo solitarius. Blue-headed Vireo. Baird.
115.* Vireo flavifrons. Yellow-throated Flycatcher.

LIOTRICHIDAE — MOCKING BIRDS.

116.* Mimus polyglottus. Mocking Bird. Not uncommon.
117.* Mimus Carolinensis. Cat-Bird. Common. Breeding abundantly in Lawrence.
118.* Harporhynchus rufus. Brown Thrush. Common.
119.* Thryothorus Ludovicianus. Great Carolina Wren. Not uncommon, but very shy; almost impossible to find its nest.
120. Thryothorus Bewickii. Bewick's Wren. Probably breeds in Kansas.

121. Cistothorus palustris. Long-billed Marsh Wren. Probably breeds in Kansas.
122. Cistothorus stellaris. Short-billed Marsh Wren. Probably breeds in Kansas.
123.* Troglodytes aedon. House Wren. Common.
124. Troglodytes hyemalis. Winter Wren. Baird.

CERTHIIDAE — CREEPERS.

125.* Certhia Americana. American Creeper.
126.* Sitta Carolinensis. White-bellied Nuthatch.
127. Sitta Canadensis. Red-bellied Nuthatch.
128.* Polioptila cærulea. Blue-eyed Gnatcatcher. Not common.

PARIDAE — TITMICE.

129.* Lophophanes bicolor. Tufted Titmouse. Abundant; a true resident, remaining through the winter.
130.* Parus septentrionalis. Long-tailed Chickadee.
131.* Parus atricapillus. Black-cap Titmouse. Common resident.

ALAUDIDAE — LARKS.

132.* Eremophila cornuta. Skylark. Very abundant; remains through the winter, when it moves in flocks and is commonly called "Snow Bird."

FRINGILLIDAE — FINCHES AND SPARROWS.

133. Pinicola Canadensis. Pine Grosbeak. "Occurs in winter; taken by Sidney Smith, of Leavenworth."
134. Carpodacus purpureus. Purple Finch. "Migratory."
135.* Chrysomitris tristis. Yellow Bird. Resident; seen in large flocks in winter.
136. Chrysomitris pinus. Pine Finch. "Rare in winter."
137. Curvirostra Americana. Red Crossbill. "Rare in winter."
138. Curvirostra leucoptera. White-winged Crossbill. "Rare in winter."
139. Plectrophanes nivalis. Snow Bunting. In winter, usually in same flock with the Skylark and Lapland Longspur.
140. Plectrophanes lapponicus. Lapland Longspur. Common in flocks in winter.
141. Plectrophanes pictus. Smith's Bunting. Baird.
142.* Plectrophanes ornatus. Chestnut-collared Bunting. Allen. Near Fort Hays. Common in Middle and Western Kansas.
143. Plectrophanes melanomus. Black-shouldered Longspur. Baird.
144. Plectrophanes Macownii. Macown's Longspur. Allen. Near Fort Hays in winter.
145. Passerculus Savanna. Savannah Sparrow.
146. Passerculus alaudinus. Lark Sparrow.
147.* Poœcætes gramineus. Grass Finch. Common.
148.* Coturniculus passerinus. Yellow-winged Sparrow. Abundant. Taken by Dr. Cooper. Nest found by E. A. Popenoe, July 7th, 1872, with nine eggs.
149. Coturniculus Henslowi. Henslow's Bunting. Shot at Topeka, April 26th, 1872, by E. A. Popenoe; two or three specimens seen.
150.* Chondestes grammaca. Lark Finch. A prairie bird and very abundant.
151. Zonotrichia leucophrys. White-crowned Sparrow.
152. Zonotrichia querula. Harris's Finch. Often taken in the winter; probably resident. Abundant in May along the Missouri river.
153. Zonotrichia albicollis. White-throated Sparrow. Common.
154. Junco Oregonus. Oregon Snow-bird. Occasional in winter; a specimen shot at Topeka, March 29th. 1870, by E. A. Popenoe.
155. Junco hyemalis. Black Snow-bird. Abundant in winter.
156. Poospiza bilineata. Black-throated Sparrow. "Taken by Dr. Coues, in Western Kansas."
157. Spizella monticola. Tree Sparrow. Abundant.

158.* Spizella pusilla. Field Sparrow. Common.
159.* Spizella socialis. Chipping Sparrow. Less common than at the East.
160.* Spizella pallida. Clay-colored Bunting. Baird.
161.* Melospiza melodia. Song Sparrow. Common in the timber.
162. Melospiza Lincolnii. Lincoln's Finch. "Migratory in spring and fall."
163.* Melospiza palustris. Swamp Sparrow. Common.
164. Peucæa Cassinii. Cassin's Finch. Allen. Near Fort Hays.
165. Passerella iliaca. Fox-colored Sparrow. Common in migration.
166. Passarella schistacea. Slate colored Sparrow. Rare; only one specimen taken.
167.* Calamospiza bicolor. Lark Bunting. "Common in Middle and Western Kansas." Also seen in Eastern Kansas by Dr. Hoy.
168.* Euspiza Americana. Black-throated Bunting. Abundant on the prairie.
169.* Guiraca Ludoviciana. Rose-breasted Grosbeak. Common in the timber.
170.* Guiraca melanocephala. Black-headed Grosbeak. Allen. Near Fort Hays.
171.* Cyanospiza amœna. Lazuli Finch. "Western Kansas."
172.* Cyanospiza cyanea. Indigo Bird. Very common.
173.* Cardinalis Virginianus. Red Bird. Abundant and a true resident, remaining in winter.
174.* Pipilo erythrophthalmus. Ground Robin, Chewink. Common and resident.

ICTERIDAE — BLACKBIRDS.

175.* Dolichonyx oryzivorus. Bobolink. Rare about Lawrence. Not uncommon in Osage county in 1872.
176.* Molothrus pecoris. Cow-bird. Abundant.
177.* Agelæus phœniceus. Red-winged Blackbird. Abundant.
178.* Xanthocephalus icterocephalus. Yellow-headed Blackbird. Abundant; generally in the same flock with the Cow-bird.
179.* Sturnella magna. Meadow Lark. Abundant.
180.* Sturnella neglecta. Western Lark. This species, though closely resembling the preceding, has an entirely different song, and presents certain well-marked and constant differences of plumage. Both species are abundant in Eastern Kansas.
181.* Icterus spurius. Orchard Oriole. Common.
182.* Icterus Baltimore. Baltimore Oriole. Not uncommon.
183. Icterus Bullockii. Bullock's Oriole. Quite frequent. Five specimens taken at Lawrence in May and June, 1871; none seen in 1872.
184. Scolecophagus ferrugineus. Rusty Blackbird. "Migratory in spring and fall."
185. Scolecophagus cyanocephalus. Brewer's Blackbird. Quite common even in Eastern Kansas.
186.* Quiscalus versicolor. Crow Blackbird. Abundant, and without fear of man, often nesting in the city of Lawrence.

CORVIDAE — CROWS.

187.* Corvus carnivorus. American Raven. "Common on the plains of Western Kansas."
188.* Corvus Americanus. Common Crow. Common, and tamer than in the Eastern States.
189.* Pica Hudsonica. Magpie. Seen in Shawnee county, in October, 1871, by C. E. Pond. Reported as breeding, by J. A. Allen.
190. Cyanura cristata. Blue Jay. Abundant, resident; has little fear of man, often nesting in Lawrence.

COLUMBIDAE—PIGEONS.

191. Ectopistes migratoria. Wild Pigeon. Not common.
192.* Zenædura Carolinensis. Carolina Dove. Abundant throughout the State.

PHASIANIDAE — PHEASANTS.

193.* Meleagris gallopavo. Wild Turkey. Becoming rare in the towns; not uncommon in the timber elsewhere.

TETRAONIDAE — GROUSE.

194.* Pediœcetes phasianellus. Sharp-tailed Grouse. Allen. Common about Fort Hays and in Middle and Western Kansas, generally near the streams.

195.* Cupidonia cupido. Prairie Chicken. Abundant. Sold in the markets for $1.50 to $3.00 per dozen; protected by game law from March first to August first.

196. Bonasa umbellus. Ruffed Grouse or Partridge. Extremely rare; taken by Charles Chadwick, Esq., of Lawrence. Probably breeds in Kansas.

PERDICIDAE — PARTRIDGES.

197.* Ortyx Virginianus. Bob White or Quail. Eastern to Middle Kansas. Abundant; sold in the market for $1.00 per dozen; protected by game law from March 1st to October 1st.

GRUIDAE — CRANES.

198. Grus Americanus. Whooping Crane. Rare in migration. A fine specimen was shot near Lawrence in November, 1871. The mounted skin is in the university museum.

199. Grus Canadensis. Sandhill Crane. Abundant during the migrations.

ARDEIDAE — HERONS.

200. Garzetta candidissima. Snowy Heron. An adult specimen was taken at Topeka by E. U. Prentice, July 25th, 1872.

201. Herodias egretta. White Heron. Not common. Taken at Lawrence, August 15th, 1872.

202. Ardea herodias. Great Blue Heron. Not common. A female in full plumage was taken at Lawrence in May, 1872.

203.* Ardetta exilis. Least Bittern.

204.* Botaurus lentiginosus. Bittern, Stake Driver. Quite common.

205.* Butorides virescens. Green Heron. Common.

206.* Nyctiardea Gardenii. Night Heron. Rare.

CHARADRIDAE — PLOVERS.

207. Charadrius Virginicus. Golden Plover. "Migratory in October."

208.* Ægialites vociferus. Killdeer. Abundant.

209.* Ægialites montanus. Mountain Plover. Allen. Common in Western Kansas.

210. Ægialites semipalmatus. Ring Plover. Common in spring and fall.

211. Ægialites meloda. Piping Plover. Baird.

212. Squatarola helvetica. Black-bellied Plover. Baird.

RECURVIROSTRIDAE — AVOCETS.

213. Recurvirostra Americana. American Avocet. Rare. Probably breeds in Kansas.

PHALAROPODIDAE — PHALAROPES.

214. Phalaropus Wilsonii. Wilson's Phalarope. "Migratory in spring and fall."

SCOLOPACIDAE — SNIPES.

215.* Philohela minor. American Woodcock. Rare.

216. Gallinago Wilsonii. English Snipe. Common.

217. Macrorhamphus griseus. Gray Snipe. Common.

218. Macrorhamphus scolopaceus. Greater Longbeak. "Migratory in spring and fall."

219. Tringa canutus. Knot, Robin Snipe. Common.

220. Tringa Alpina, var. Americana. Red-backed Sandpiper. Allen. Near Leavenworth.

221. Tringa maculata. Jack Snipe. Common.

222. Actodromas Bairdii. Baird's Sandpiper. Baird.
223. Tringa Wilsonii. Least Sandpiper. Abundant.
224. Tringa Bonapartii. Bonaparte's Sandpiper. "Migratory in spring and fall."
225. Ereunetes petrificatus. Semipalmated Sandpiper. "Migratory."
226. Symphemia semipalmata. Willet. "Occasional in fall." A large flock was seen on the Kansas River, near Lawrence, April 25, 1872.
227. Gambetta melanoleuca. Tell-tale, Stone Snipe. Common.
228. Gambetta flavipes. Yellow-legs. Abundant.
229.* Rhyacophilus solitarius. Solitary Sandpiper. Rare.
230.* Tringodes macularius. Spotted Sandpiper. Rare.
231.* Actiturus Bartramius. Field Plover. Abundant on the open prairie in May.
232. Tringites rufescens. Buff-breasted Sandpiper. Occasional in fall.
233. Limosa fedoa. Marbled Godwit. Rare.
234. Limosa Hudsonica. Hudson Godwit. Baird.
235.* Numenius longirostris. Long-billed Curlew. Not uncommon. Found breeding on the Plains of Western Kansas, by J. A. Allen.
236. Numenius Hudsonicus. Hudsonian Curlew. Baird.
237.* Numenius borealis. Esquimaux Curlew. Allen. A single specimen seen in Western Kansas. Mr. Allen reports it as breeding in Kansas.

RALLIDAE — RAILS AND COOTS.

238. Rallus elegans. King Rail. Rare.
239.* Rallus Virginianus. Virginia Rail.
240. Porzana Carolina. Common Rail.
241. Porzana Jamaicensis. Little Black Rail. Allen. A single specimen taken.
242.* Fulica Americana. Coot, Mud-hen. Abundant in spring and fall.
243. Gallinula galeata. Florida Gallinule. Baird.

ANATIDAE — SWANS, GEESE, DUCKS.

244. Cygnus Americanus. American Swan. Rare.
245. Cygnus buccinator. Trumpeter Swan. "Migratory; breeds in Iowa."
246. Anser hyperboreus. Snow Goose. Common in migration.
247. Anser Gambelii. Laughing Goose. Taken at Topeka, February, 1872, and a Lawrence, September, 1869.
248. Bernicla Canadensis. Canada Goose. Abundant in spring and fall, sometimes remaining all winter.
249. Bernicla Hutchinsii. Hutchins's Goose. Baird.
250. Bernicla brenta. Brant. Common.
251. Anas boschas. Mallard. Common.
252. Anas obscura. Black Duck. Not common.
253. Dafila acuta. Common. Sometimes remains in winter.
254.* Nettion Carolinensis. Green-winged Teal. Abundant.
255.* Querquedula discors. Blue-winged Teal. Abundant. This and the preceding reported as breeding, by J. A. Allen.
256. Spatula clypeata. Shoveler. Common.
257. Chaulelasmus streperus. Gadwall. Common.
258. Mareca Americana.
259.* Aix sponsa. Summer or Wood Duck. The young of this species are good shooting and fine eating in August and September. Nearly all the other species are abundant for about two months, both in spring and fall, and are very common in the market.
260. Fulix marila. Greater Black-head, Blue-bill, Scaup Duck. Common.
261. Fulix affinis. Little Black-head. Common.

262. Fulix collaris. Ring-necked Duck. Common.
263. Aythya Americana. Red-head. Abundant.
264. Aythya vallisneria. Canvas-back. Not common.
265. Bucephala Americana. Golden Eye, Whistle Wing. Rare.
266. Bucephala albeola. Butter Ball. Common.
267. Erismatura rubida. Ruddy Duck. Rare.
268. Mergus Americanus. Sheldrake, Fish Duck. Common.
269. Mergus serrator. Red-breasted Merganser. Baird.
270. Lophodytes cucullatus. Hooded Merganser. Common.

PELECANIDAE — PELICANS.

271. Pelecanus erythrorhynchus. American Pelican. Common during the migrations, especially in the fall. A specimen taken near Lawrence, October 20, 1871, measured eight feet and five and three-sixteenth inches from tip to tip of wings.

PHALACROCORACIDAE — CORMORANTS.

272. Graculus dilophus. Double-crested Cormorant. Rare in migration.
273. Graculus Mexicanus. Mexican Cormorant. Rare; a single specimen taken four miles south of Lawrence, April 2d, 1872, by Geo. D. Allen. This is the first specimen taken north of the Rio Grande.

LARIDAE — GULLS, TERNS.

274. Larus argentatus. The Herring Gull or Silvery Gull. A single specimen is in possession of E. U. Prentice, Esq., of Topeka, who has prepared a fine collection of mounted birds.
275. Chrœcocephalus Franklinii. Franklin's Rosy Gull. A beautiful mounted specimen is in Mr. Prentice's collection.
276. Sterna Wilsoni. Wilson's Tern. Rare in migration.
277. Sterna Forsteri. Forster's Tern. Migratory.
278. Sterna frenata. Least Tern. Rare.
279. Hydrochelidon plumbea. Short-tailed Tern. Migratory.

COLYMBIDAE — GREBES.

280. Colymbus torquatus. Loon. Migratory.
281. Podicipes cornutus. Horned Grebe.
282. Podilymbus podicipes. Carolina Grebe, Dabchick. Common. Probably breeds in Kansas.

LAWRENCE, KANSAS, April 7th, 1873.

COALS OF KANSAS.

BY WILLIAM H. SAUNDERS.

At the request of Secretary Parker, I have condensed in the following paper the results of some chemical investigations, which I have from time to time made, of the quality of our Kansas coals.

Up to this time, so far as I know, no true bituminous coal has been found west of the Missouri river, and probably none exists.

Many valuable beds of coal, some of which are many feet in thickness, occur throughout the western part of the country, but all belong to that class of coals called lignites. On a close examination of the most compact, homogeneous specimens, laminæ of a soft, black, pulverulent substance like charcoal, retaining its original organic structure can be found, which assign them to the class of lignites.

In Kansas all qualities are found, from the soft, brown, woody lignite, destitute of bituminous matter, and showing plainly the original vegetable structure, to that so highly bituminized and homogeneous in quality, as to approach very nearly a true bituminous coal.

The general distribution, good quality, and easy access of our coal beds render it highly probable that in years to come Kansas may be made commercially independent, by the possession of a cheap means of preparing for use the crude products of the vast and varied industries that her fertile soil and varied resources are capable of sustaining.

The eastern half of the State lies on the western border of the great interior coal basin of the continent, where the outcrop of the strata would bring the coal to the surface. Owing to the very slight disturbance of the strata in this part of the west, they lie nearly horizontal, having a slight dip to the northwest and north, thus insuring the distribution of coal over a large area, and greatly facilitating mining operations, for, when once a bed is reached, the miner can work in any direction with no prospect of having his progress impeded by a fault in the strata.

At numerous places throughout the eastern half of the State, thin beds of coal of the upper coal measures outcrop along the hillsides,

but the thickest and best beds yet discovered outcrop in the lower coal measures of the extreme southern part and below.

As the dip of the strata is so uniform, and thick beds are generally continuous over a large area, an estimate can readily be made of the approximate depth it will be necessary to go at any point to reach them. Upon such a basis work was commenced in the shaft at Leavenworth, and coal reached at about the depth anticipated, although not of as great thickness as was expected.

In the northern part of Bourbon county, and from thence in a line northeast and southwest, outcrops a fine stratum of coal about thirty inches thick, called the "Osage vein," but generally known throughout the State as Fort Scott coal. This appears in commerce under two names, black and red; names derived from the external appearance of the lumps, the real difference in quality, if any, being in favor of the black. It contains a large amount of bituminous matter that furnishes abundantly a gas of high illuminating power. The amount of ash and sulphur it yields is a little larger than some other coals yield, but this does not detract materially from its superiority over most of them for general use. The coke from it is firm, but does not possess the body of coke from the best eastern coals

Farther south, in the center of Cherokee county, outcrops another stratum of coal six feet thick, that also stretches northeast and southwest, and is of finer quality than the preceding. For the production of gas and heating purposes it is the best coal in the State, the only drawback being a tendency to run together into a solid coke in the furnace, which, however, by a little attention, can be readily prevented. It yields a much larger quantity of illuminating gas than the Fort Scott coal, of equal quality, gives a coke of more body and heating capacity, less ash, and but little more sulphur. The Lawrence and Kansas City gas companies, after a thorough trial, pronounce this the best coal for the manufacture of gas that they can obtain from Kansas or Missouri.

The Leavenworth mine furnishes a fine, compact coal of greater heating capacity than the Fort Scott, but not equal to the Cherokee. It is not as rich in bituminous matter as the Fort Scott, and contains a decidedly larger percentage of sulphur that causes it to "clinker" badly.

These three are the best and leading coals of the State. Besides these, only two other fields are worked to any extent; one, the Osage county field, stretching from Carbondale to Osage City; the other at Grayville, Franklin county. These are of about the same quality, from twenty-four to thirty inches in thickness, yield a small

amount of illuminating gas of fair quality, a moderate per cent. of sulphur, a large per cent. of ash, and coke of inferior quality. These two coals, however, in one respect are superior to the others. They do not give a heavy coating of soot to everything in contact with their smoke, but burn clean, a fact which will recommend them strongly for use in the kitchen where utensils are frequently handled.

With increased railroad facilities the demand of the greater portion of the State will, without doubt, be supplied from the fields already mentioned.

No good coal has yet been found in Western Kansas. A few years ago a heavy bed of brown coal or pure lignite was worked at Wilson's creek, on the K. P. Railway, that in time may become valuable in that region so scantly supplied with fuel. It is notable for containing less sulphur than any other coal which I have seen in Kansas.

For use in metallurgy all our coals contain too much sulphur, and will require coking.

In the following tables are given the results of the chemical analyses which I have made of coals from Kansas and other parts of the west:

	KANSAS COALS.					COLORADO COALS.						MISSOURI.
	Wilson's Creek, K. P. R. W.	Carbondale, Osage county.	Coal Creek, Douglas county.	Lawrence Mine, Franklin county.	Fort Scott.	Marshall's Vein.	Golden City.	Kiowa.	Bijou Creek, (Cannel.)	K. P. R. W.	K. P. R. W.	Camden.
Water	7.50	.....	11.53	11.00	15.90	8.08	10.00	7.70	13.00	11.00	13.00	.....
Combustible Gases, cubic feet per pound	2.33	3.00	2.29	2.35	3.04	0.30	1.79	4.01	1.81	1.64	1.40	3.50
Illuminating power	low	high	high	high	highest	very low	fair	none	fair	low	none	high
Amount of Tar	small	medium	small	medium	medium	small	small	small	small	large	small	small
Sulphur	1.63	3.70	3.69	3.45	4.10	1.95	2.60	2.46	2.21	1.50	0.89	3.59
Coke	68.75	69.03	62.50	59.89	66.15	75.60	58.86	48.44	55.54	52.00	52.34	53.91
Ash	9.50	12.31	5.25	9.20	12.05	3.00	4.46	10.28	5.50	6.18	17.50	12.00
Rate of combustion in open air	fast	slow	medium	slow	medium	slow	medium	slow	fast	medium	medium	medium
OR:												
Volatile Matter	31.25	30.97	37.59	40.11	33.35	24.10	41.14	51.56	44.46	48.00	47.66	46.09
Fixed Carbon	59.25	56.72	57.25	50.69	54.10	72.60	54.40	38.16	50.04	45.82	34.84	41.91
Ash	9.50	12.31	5.25	9.20	12.05	3.00	4.46	10.28	5.50	6.18	17.50	12.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

From this table it will be seen that a marked difference exists between the coals of Kansas and those to the west of us. Sulphur diminishes to so small an amount westward, that the coals can be used in the raw state for metallurgy. The amount of volatile matter increases, but this is chiefly hydrogen with little or no illuminating power. The fixed carbon and the ash diminish.

Of those that I have analyzed, and others that I have seen, none are, I think, equal for general use, to our Cherokee coal.

One given in the table, Marshall's vein, differs in a marked degree, from all others. Its output is on South Boulder creek, at the base of the mountains near Denver, embracing a series of eleven beds that vary from five to thirteen feet in thickness. In appearance like anthracite, having a bright lustre, homogeneity of structure, leaving no stain when handled, containing but a slight amount of volatile matter, one is tempted, at first sight, to pronounce it anthracite, but an occasional thin lamina of pulverulent, carbonaceous matter shows that its place is among the lignites. Not the least item of interest is the small per cent. of sulphur in its composition, an amount that will not interfere with its use in the raw state for the working of metals. For all purposes, except the production of gas, this coal is the best of which I have any knowledge in the west.

The coal from Bijou creek is chiefly cannel coal, but does not contain the amount of bituminous matter usually found in this variety, which, elsewhere, is the most valuable of all for the production of illuminating gas.

LIMESTONES AND COAL.

CHEMICAL ANALYSES BY WILLIAM H. SAUNDERS.

The following quantitative chemical analyses are of two varieties of limestones from Junction City, and two varieties of coals, found along the line of the Kansas Pacific railroad, in Colorado. Stone No. 1 is the quality ordinarily used. No. 2 is from a new quarry lately opened. A decided difference will be noticed between the samples. No. 2 is free from pores, and although it has a very considerable amount of magnesia in its composition, it is my opinion, based on its compactness, the large amount of silicates present, and its slow solubility in acids, that it will prove more durable than the quality ordinarily used. The color, a light drab, is very fine:

LIMESTONES.	No. 1.	No. 2.
Hygrometric moisture escaping at 212° F.	.55	.75
Carbonate of Lime	88.85	67.23
Carbonate of Magnesia	4.15	17.45
Sesqui-oxide of Iron and Alumina, mostly Iron	1.20	2.05
Insoluble Silica and Silicates	5.10	12.20
Loss	.15	.32
	100.00	100.00

COAL NO. 1.

Water, hygrometric	11.00
Illuminating Gas	per lb., 1.64 cub. ft.
Quality	poor
Tar	abundant
Sulphur	1.50
Coke	52.00
Ash	6.18
Rate of Combustion in open air	medium

or,

Volatile matter	48.00
Fixed Carbon	45.82
Ash	6.18
	100.00

COAL NO. 2.

Water, hygrometric	13.00
Uncondensed Gases	per lb., 1.40 cub. ft.
Illuminating quality	none
Tar	small amount
Sulphur	0.89
Coke	52.34
Ash	17.50
Rate of combustion in open air	medium

or,

Volatile matter	47.66
Fixed Carbon	34.84
Ash	17.50
	100.00

No. 1 is a cannel coal. No. 2 is a fair lignite, distinguished for containing a very small per cent. of sulphur.

RED SANDSTONE OF CENTRAL KANSAS.

BY B. F. MUDGE.

Next above the Permian a belt of red sandstone, corresponding in appearance and (in part) in position with the new red sandstone of the older geologists, crosses the State of Kansas from the State line in Washington county in a southwesterly direction to the Indian Territory, passing out of the State near its southwestern corner. Its extent within our State is about three hundred miles, and its width in a northwesterly line varies from thirty to fifty miles. The middle and lower portion of this deposit has usually been assigned to the Triassic, but as it contains scarcely any fossils, and those not in good preservation, its true position is still uncertain. Prof. Swallow found but a single fossil, and that a doubtful nucula.* Other geologists have succeeded no better in collecting or identifying the fossils of this division of the red sandstone of Kansas. The only evidence that any portion of this sandstone is older than the Cretaceous, is the fact that in northern Nebraska, under the red sandstone of the Cretaceous, is a deposit of sandstone in physical characteristics, identical with ours, in which the fossils are recognized by Meek as clearly Jurassic. As the Cretaceous is traced uninterruptedly from thence to Kansas, and no unconformability is anywhere seen, it is not improbable that a portion of our territory is covered with Triassic or Jurassic rocks. Until further discoveries are made the question must be considered an open one, whether either of these formations exist in Kansas, though my opinion is they do not.

While we were in doubt concerning the age of the lower portion of this red sandstone deposit, we are not left in doubt in relation to the true position of the higher strata. Although there is no difference in the higher and lower strata, and it is even difficult to trace a single bed and identify it over an extent of twenty miles, yet the fossils of the later or higher deposits are well preserved and unmistakably Cretaceous.

The most marked and important fossils are the leaves of dicotyledonous plants. These are usually in good state of preservation, the veins and veinlets being frequently as clearly visible in all their outlines, as they lie imprinted on stone, as those just taken from living trees. These represent about a dozen different genera, the

* Meek, in the last report on the geology of this State and the adjoining territories, does not mention any Triassic fossils as found in Kansas.

most common of which are Liquidambar, Populus, Salix, Fagus, Quercus, Platanus, Sassafras, Liriodendron, Magnolia, and, more rarely, the Cinnamomum. These are represented by about fifty species, all extinct. In addition we find some of extinct races, as the Creducria and Dombeiopsis.

These fossils are found at uncertain intervals of territory. In searching for them we have frequently examined every visible outcrop for fifteen or twenty miles without finding a specimen, then perhaps a single square mile would furnish several good localities.

Our cabinet is represented by specimens collected from twenty-five or thirty places, from Washington county to Fort Larned, near the Arkansas, a distance of one hundred and seventy-five miles. The fossil plants are usually obtained from thin layers or strata, extending in a horizontal position along a ravine or around a hill. They may occur at several places in the same vicinity, but usually without any connection. Thus in Clay county, near Riverdale, they were found at the bottom of a well, as low as the bed of the Republican, and on the top of an adjoining hill two hundred feet high, with numerous strata between, in which none could be seen.

These deposits appear to have been local, dependent upon circumstances. There must have been, necessarily, an arm of the sea or lake, with soft, sandy mud, bordered by an adjoining dry land covered with a forest. The characteristic of the local deposits indicate that the forests were on small islands sparsely scattered over the Cretaceous ocean.

While plants are thus widely scattered in this sandstone, other fossils are extremely rare. In the vicinity of Fort Harker a few fish vertebræ and sharks' teeth are found. Though we have carefully searched over a large portion of the country covered by this deposit, both in the Cretaceous and the beds called Triassic, for mollusks and the common marine fossils, we have discovered them in but one locality, and that of very limited area.*

Three years ago, passing from Salina to Harker, when near what is now the town of Bavaria, we picked up in the road some marine fossils. Tracing the specimens to the top of an adjoining hill, we found a few acres covered with a stratum not over two feet in thickness, rich in small shells. We sent a box to Prof. Meek, of the Smithsonian Institution, for critical examination, who found twelve species new to science, a full description of which can be seen in Hayden's recent report of the United States Geological Survey of Wyoming and contiguous Territories, pages 297–313.

*Since the reading of this article before the Society, another locality has been found about four miles from Bavaria. They are in good preservation, differing very much from the first locality, but have not yet been critically examined.

The following is the list, which we believe includes nearly all the mollusks thus far found in the red randstone within the bounds of Kansas:

Crassatellina oblonga.
Area (?) parallela.
Yoldia microdonta.
Cardium Kansensis.
Cardium (Protocardia) Salinense.
Cyrena (Corbicula?) nucalis.
Cyrena(Corbicula?)subtrigonalis.
Tellina subscitula.
Tellina (?) mactroides.
Leptosolen Conradi.
Turritella Kansensis.
Turbo Mudgeanus.

These shells are in the same strata and in the vicinity of several deposits of the dicotyledonous leaves, and with the plants identify this portion of the sandstone as belonging to the Dakota group of the Cretaceous, as described by Meek and Hayden in their first report.

The sandstone varies in a great degree in various localities, and even in the same quarry. In color it varies from white to nearly black, but usually of a dark brown. Much of it makes an excellent building material, being durable and easily wrought.

Within the past four years the leaves have been found lower down, or nearer the Permian than they were previously known to exist. Those at the bottom of the well in Clay county must have been less than two hundred feet from the Permian.

The line of demarkation between the different geological formations of Kansas are very obscure. A physical unconformability I have never seen, and the division, as shown by a difference of fossils, the best criterion, is also very indistinct. We must consider, also, that the sandstones called Triassic and the Cretaceous in Kansas are so similar in color, hardness, fineness, and chemical elements, that were a hundred tons of each thrown into the door yard of Dana, the great geologist and mineralogist, he could not, from any of the characteristics (aside from fossils) tell to which of the two formations either pile belonged.

CLIMATE OF KANSAS.

BY PROF. FRANK H. SNOW.

STATE UNIVERSITY, LAWRENCE, KANSAS, January 1st, 1873.

HON. ALFRED GRAY, *Secretary State Agricultural Society:*

DEAR SIR: In compliance with your request I send you this day the following facts in regard to the climate of Kansas, embodying the results of my own observations since January 1st, 1868. The geographical position of Lawrence is such that these observations may be safely presumed to represent the average meteorological conditions of the eastern half of Kansas. The precise location of this station is as follows: Latitude 38° 58′; longitude 95° 16′; elevation of instruments 884 feet above the level of the sea. The instruments are of the highest standard quality, most of them from the manufactory of James Green, of New York City, maker of instruments for the Smithsonian Institution. In addition to the ordinary apparatus for taking what are called "first-class" observations, the University now possesses and has in successful operation a complete and highly valuable collection of self-registering instruments, by means of which the velocity of the wind, the direction of the wind, the height of the barometer column, and the rainfall, are recorded for every instant of time. This automatic apparatus cannot fail to greatly enhance the value of the meteorological work performed under the auspices of the State University. For example, the determination of the velocity of our Kansas winds will doubtless dispel many vague and exaggerated notions now prevalent concerning this peculiar feature of our climate.

The first element to be considered in our climatology is

TEMPERATURE.

The following table gives the mean temperature of each month and year over which our observations have extended:

Table I.—Mean Monthly Temperature at Lawrence, Kansas.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1868	23.°067	35.°071	50.°091	49.°065	66.°076	75.°005	85.°090	74.°017	62.°037	53.°006	37.°099	24.°023
1869	30. 50	30. 63	35. 07	49. 44	59. 87	66. 86	72. 22	75. 30	59. 93	13. 75	42. 39	36. 92
1870	29. 43	35. 42	37. 69	56. 84	68. 00	73. 71	80. 27	73. 54	67. 88	56. 50	44. 92	28. 70
1871	28. 86	35. 30	47. 42	57. 90	66. 65	76. 85	80. 28	75. 34	65. 16	6. 05	35. 89	24. 91
1872	24. 35	30. 44	37. 23	56. 42	65. 98	76 98	77. 96	77. 27	66. 73	5. 64	33. 36	19. 96
Mean for five years	27. 36	33. 50	41. 66	54. 05	65. 45	73. 89	79. 33	75. 12	64. 41	3. 00	8. 91	26. 95

From the preceding table it will be seen that the monthly temperatures are subject to considerable variation. Thus, March and November are sometimes winter months, while May and September are occasionally summer months. The second half of May and the first half of September almost invariably belong to the summer season.

The mean temperatures of the different seasons, together with the mean annual temperature, are shown in the following table:

Table II.—Mean Temperatures of Seasons and Years at Lawrence, Kansas.

Years.	Spring.	Summer.	Autumn.	Winter.	Year.
1868	55.°077	78.°037	51.°014	27.°089	53.°036
1869	48. 15	71. 17	48. 64	32. 70	50. 36
1870	54. 15	75. 86	56. 43	31. 04	54. 50
1871	57. 32	77. 50	52. 33	29. 50	54. 30
1872	53. 21	77. 40	51. 91	24. 91	51. 90
Mean for five years	53. 72	76. 06	52. 09	29. 21	52. 88

The mean annual temperature, as given in the preceding table, does not differ essentially from that of the States to the east of Kansas in the same latitude, viz.: Missouri, Southern Illinois, Southern Indiana, Southern Ohio, Kentucky, Virginia, and Maryland.

The summers of Kansas, however, are somewhat warmer and the winters considerably colder than those of the states just mentioned, which is to be explained by the fact that the warm winds from the heated, treeless plains on the southwest, and the cold winds from the snow-clad mountains on the northwest, sweep over Kansas with little diminution of their original intensity of temperature.

THE SUMMER SEASON.

The average number of days on which the mercury reached or exceeded ninety degrees during the five summers observed, was thirty-eight. In the cool summer of 1869 there were only twenty-three such days, while in the hot summer of 1870 there were forty-six. But though the thermometer indicates a higher temperature on a greater number of days in Kansas than in States in the same latitude on the east, there are important compensations by which the summer heat is, on the whole, as easily borne as in the eastern States. In July, 1870, for instance, though the mean temperature at 2 P. M. was nearly ninety-one degrees for the entire month, the nights were invariably cool, the mean temperatures at 7 A. M. and 9 P. M. being seventy-four and seventy-six degrees respectively. Another compensation is the constant circulation of the air, which rarely becomes calm in the summer season. Still another, and most important modifier of the heat, is the dryness of our Kansas atmosphere,

which is a general characteristic of the climate and makes the high temperature of midsummer comparatively easy to endure. The greater the amount of moisture in the air, the more oppressive becomes the heat, so that eighty degrees in Philadelphia is more intolerable than ninety degrees in Lawrence.

THE WINTER SEASON.

The winters of Kansas are generally open, the fall of snow being comparatively light, rarely exceeding six inches in depth for a single storm. The average annual depth of snow for the five years observed was 21½ inches, the least amount being 9½ inches in 1870, and the greatest 29¾ inches in 1871.

There is great variation in the severity of our winter months. In 1869 the mercury sank below zero on but two days, the lowest point being only five degrees below zero, while in 1872 the zero point was passed on sixteen days, the lowest point being eighteen degrees below zero, and the mercury being below zero during some portion of the twenty-four hours on eight successive days (Dec. 20th to 27th).

There is also great variation in the duration of the winter seasons. In the winter of 1867–68, farmers were plowing during the whole of December and until the fifth day of January, on which date winter properly began. Uninterrupted cold weather then continued until the twelfth of February, when the winter was at an end after an existence of 38 days. Farmers were plowing again on the fifteenth of February, and there were only five days thereafter (four in February and one in March,) on which the mean temperature fell below the freezing point. The winter of 1871–72, on the other hand, was nearly three months in length, extending from the eighteenth of November to the fifteenth of February. The Kansas river was closed at Lawrence on the twenty-seventh of November and was not opened until the twenty-third of February, a period of 88 days.

KANSAS TEMPERATURE COMPARED WITH THAT OF OTHER STATES.

As furnishing the means of comparing the mean temperatures of Kansas with those of other States, the following table is introduced, which, together with a similar table concerning the rainfall, was prepared by the writer for Mr. C. C. Hutchinson's "Resources of Kansas." These tables were compiled from the observations of the four hundred meteorological observers of the Smithsonian Institution, of whom nearly twenty are located in different parts of Eastern Kansas, including Atchison on the north, Baxter Springs on the south, Leavenworth and Olathe on the east, and Manhattan on the west. Only twenty States are represented in this comparison, those States engaged in the rebellion being omitted because the returns from them for the years 1865, '66 and '67 are too meagre to afford trustworthy results:

Table III.—Mean Temperature of Kansas in comparison with that of other States, from January first, 1865, to January first, 1870.

State.	Spriug.	Summer.	Autumn.	Winter.	Year.
Kansas	52.°2	75.°5	54.°3	29.°1	52.°8
Maine	40. 7	66. 4	46. 6	19. 8	43. 4
New Hampshire	41. 7	66. 7	46. 6	20. 4	43. 8
Vermont	40. 4	66. 1	45. 6	18. 4	42. 7
Massachusetts	45. 0	68. 6	49. 7	25. 5	47. 2
Connecticut	45. 0	69. 1	50. 4	25. 8	47. 6
New York	43. 9	69. 7	50. 0	24. 9	47. 1
New Jersey	49. 8	72. 3	54. 3	30. 3	51. 7
Pennsylvania	47. 3	71. 7	52. 0	28. 1	49. 7
Maryland	51. 7	74. 2	55. 6	32. 4	53. 5
Kentucky	54. 4	74. 5	55. 7	35. 2	54. 9
Ohio	49. 4	72. 6	52. 7	29. 1	50. 9
Michigan	42. 4	67. 8	49. 1	24. 2	45. 9
Indiana	50. 4	74. 2	53. 2	29. 7	51. 9
Illinois	47. 6	72. 9	52. 0	25. 8	49. 6
Wisconsin	41. 8	68. 6	47. 8	20. 5	44. 7
Minnesota	39. 4	67. 8	45 3	14. 0	41. 6
Iowa	44. 5	71. 2	48. 9	20. 3	46. 2
Missouri	52. 5	75. 5	55. 0	30. 7	53. 4
Nebraska	45. 9	73. 4	51. 0	22. 9	48. 4
Mean for twenty States	46. 3	70. 9	50. 8	25. 4	48. 3

RANGE OF TEMPERATURE.

In estimating the influence of climate upon agriculture, it is important to know not only the mean temperature, but also the range of temperature for each month and season. The horticulturist will not wisely place his chief dependence upon a kind of fruit which is liable to be entirely cut off by the extreme cold of winter or the severe frosts of spring. The farmer will not wisely venture his all upon a crop which the intense heat of an exceptionally hot summer would certainly destroy, nor can he safely delay his harvesting beyond the time when the records show the possible occurrence of the first "killing frost" of autumn.

The following table gives the extremes of temperature for each month of the past five years:

Table IV.—Extremes of Temperature for each month at Lawrence, Kansas, from January first, 1868, to January first, 1873.

Month.	1868.		1869.		1870.		1871.		1872.		Mean monthly range.
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	
January	64.°0	—7.°0	56.°0	6.°0	56.°5	—1.°0	67.°5	—5.°0	50.°5	—7.°5	61.°8
February	72. 0	—3. 0	66. 0	—5. 0	69. 0	—4. 0	71. 5	—6. 0	61. 0	-12. 0	73. 9
March	93. 0	22. 0	81. 0	—1. 0	71. 0	1. 0	78. 0	25. 5	72. 0	18. 0	65. 9
April	83. 0	25. 0	87. 0	18. 0	91. 0	19. 0	92. 0	30. 5	85. 0	30. 0	63. 1
May	84. 0	49. 0	88. 0	25. 0	90. 0	44. 0	92. 0	37. 0	88. 0	39. 0	47. 6
June	99. 0	57. 0	90. 0	37. 0	102. 0	44. 0	96. 0	63. 0	97. 0	53. 0	46. 0
July	101. 0	70. 0	93. 0	47. 0	99. 0	55. 0	103. 0	60. 0	93. 5	61. 5	39. 2
August	93. 0	57. 0	96. 0	56. 0	98. 0	53. 0	100. 0	45. 0	97. 0	53. 0	44. 0
September	93. 0	29. 0	85. 0	30. 0	88. 5	53. 0	92. 5	36. 0	94. 0	37. 0	53. 6
October	82. 0	25. 0	78. 0	15. 0	79. 0	29. 0	90. 0	32. 0	92. 0	27. 0	58. 6
November	73. 0	17. 0	72. 0	23. 0	72. 0	17. 0	72. 5	3. 0	67. 0	—1. 0	59. 5
December	53. 0	-16. 5	65. 0	4. 0	64. 0	-10. 0	58. 0	—6. 0	58. 5	-18. 0	69. 0

LONG PERIOD OF ABSENCE OF FROST.

An important point to be noticed in considering the preceding table is the long period of absence of frost. The average date of the last light frost of spring is April 15th; that of the first light frost in autumn is September 25th, giving an average interval of 164 days entirely without frost. The period of immunity from *severe* frosts is considerably longer, averaging 194 days, from about the fifth of April to the fifteenth of October. The April frosts are not often severe enough to materially injure fruit buds. In April, 1868, the thermometer marked seven degrees below the freezing point, but the fruit crop was not damaged, though peaches, pears and plums were in full blossom at the time. In April, 1870, however, on the sixteenth, the mercury fell thirteen degrees below the freezing point and nearly all pears, plums, early apples and budded peaches were killed; while grapes, strawberries and other small fruits were almost entirely uninjured. Of all our leading fruits the peach alone is sometimes fatally affected by the extreme cold of winter, as was the case in December, 1868, and December, 1872. Under ordinary circumstances the peach bud seems incapable of surviving a greater intensity of cold than fifteen degrees below zero. From the two causes already mentioned, the occasional very severe frosts of April and the extreme cold of winter, a good crop of peaches cannot reasonably be expected in Kansas in a series of years oftener than about half the time. Thus, in 1868, 1871, and 1872, this fruit was produced in great abundance, while in 1869, 1870, and 1873 (speaking prospectively of the latter year), the supply was exceedingly deficient, and limited almost entirely to late-ripening seedlings.

The preceding remarks will serve to show the necessity of choosing the best location for an orchard and the best varieties of fruit. A northern slope is preferable to a southern, since in the former location the buds are less liable to be prematurely expanded; the upland prairie is preferable to the bottom lands because the frosts are less severe as elevation above the streams is increased; and those varieties of fruit should take precedence which are most likely to postpone the period of blossoming until after the severe frosts of early spring. The foregoing observations will serve to show that so far as temperature is concerned the climate of Kansas is naturally adapted to the successful production of the great staples of agriculture peculiar to the middle latitudes of the United States. Indeed the long period of freedom from frost, and the prolonged heat of the summer season would seem at least to invite experiment in the culture of crops generally considered to belong to a more southerly latitude.

The second element which demands attention in estimating the climate of Kansas is the

RAINFALL.

The annexed table indicates the amount of rain in inches, including melted snow, for each month of the period under discussion :

Table V.—Rainfall in inches for each month, at Lawrence, Kansas, from January first, 1868, to January first, 1873.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1868	0.36	0.19	3.46	2.95	2.81	3.80	4.05	8.32	4.29	1.58	3.54	2.13
1869	2.90	1.44	1.15	2.43	3.64	7.57	5.05	6.46	4.45	0.69	1.86	0.87
1870	0.67	0.03	1.86	1.08	2.46	1.88	5.58	6.69	2.82	6.96	0.57	0.72
1871	1.11	2.43	1.73	2.38	2.79	4.06	7.30	2.76	1.49	3.58	2.48	1.12
1872	0.17	0.82	2.92	4.74	5.72	1.30	6.50	4.71	2.55	1.95	0.01	1.24
Mean..	1.04	0.98	2.22	2.72	3.48	3.72	5.70	5.79	3.12	2.95	1.69	1 22

The above table shows the peculiar distribution of rain through the different months of the year. Beginning with February, in which the average precipitation is reduced to its minimum, there is a constant increase in each month until July and August, when the rainfall reaches its maximum and begins to decline, each succeeding month showing a decrease in the average amount until the minimum is again reached in February. And while this regularity is seen to exist in the *average* monthly supplies of rain, it will be observed that in no single month of the growing season in either of the five years was the rainfall so light as to interfere in any considerable degree with the proper growth and ripening of the staple productions of the farmer. The comparative amounts of rain for the different seasons and the annual amounts are exhibited in an additional table:

Table VI.—Mean Precipitation of Rain for Seasons and Years at Lawrence, Kansas.

Years.	Spring.	Summer.	Autumn.	Winter.	Year.
1868	9.22 in.	16.17 in.	9.41 in.	2.68 in.	37.48 in.
1869	7.22	19.08	7.00	5.21	38.51
1870	5.40	14.15	10.35	1.44	31.32
1871	6.90	14.12	7.55	4.66	33.23
1872	13.38	12.51	4.51	2.26	32.63
Mean	8.42	15.21	7.76	3.24	34.63

A remarkable feature in the rainfall of Kansas is made evident by the preceding table, from which it appears that only about one-tenth of the annual precipitation occurs in the winter months. In the eastern States the amount of rain, including melted snow, is nearly as large in winter as in each of the other seasons. In Kan-

sas, which has less rain in winter than any State in the Union except Minnesota and Nebraska, the apparent deficiency is abundantly made good by a more copious supply of rain in spring, summer and autumn than is received by the great majority of the other States. In confirmation of this statement, and for a more extended comparison, the following table is introduced, based, like table III, upon the observations of the observers of the Smithsonian Institution, and representing the rainfall in nearly twenty different localities in eastern Kansas. It appears from the table that during the five years from January 1st, 1865, to January 1st, 1870, the average annual rainfall for Kansas was greater than that of the following states: New Hampshire, Vermont, Ohio, Michigan, Illinois, Wisconsin, Minnesota, Iowa, Missouri and Nebraska, (10 States out of the 19); also that the average amount of rain for the spring, summer and autumn months was greater in Kansas than in any of the other States except Connecticut, Maryland, New Jersey and Kentucky; and finally that for the seven months from the first of March to the first of October, when rain is needed for the germination and growth of crops, Kansas stands at the head of the list, having more rain than any of the nineteen States with which the comparison was made. It will be observed that the quantities for Kansas are greater in this table than in tables V and VI, based upon the observations of the writer. This may be accounted for by remembering that the periods of observation are not the same, and that certain other places in Kansas, especially in the southern portion, have undoubtedly a greater rainfall than Lawrence:

Table VII.—Rainfall of Kansas compared with that of other States, from Jan. 1, 1865, to Jan. 1, 1870

States.	Spring.	Summer.	Autumn.	Winter.	March 1st to Oct. 1st	Year.
Kansas	10.82	18.06	9.79	5.42	34.15	44.09
Maine	13.74	10.55	13.33	9.99	28.23	47.61
New Hampshire	10.40	10.49	12.66	7.85	25.40	41.40
Vermont	10.31	10.44	11.82	7.32	25.01	39.89
Massachusetts	13.46	11.17	11.72	10.20	28.71	46.55
Connecticut	13.01	13.34	13.11	10.54	30.88	50.00
New York	11.16	11.19	12.41	9.92	26.85	44.68
New Jersey	13.18	13.88	12.53	11.39	31.81	50.98
Pennsylvania	12.04	12.46	11.17	10.01	29.05	45.68
Maryland	13.67	13.95	12.39	11.22	32.05	51.23
Kentucky	15.18	13.77	9.88	12.50	33.92	51.33
Ohio	12.34	11.73	9.80	8.09	29.24	41.96
Michigan	8.32	9.90	11.00	6.47	23.19	35.69
Indiana	14.35	12.84	10.32	9.27	32.94	46.78
Illinois	11.53	12.07	8.14	6.02	27.92	37.76
Wisconsin	8.92	13.23	8.16	5.87	25.53	36.18
Minnesota	6.09	13.39	8.42	3.78	24.43	31.68
Iowa	10.57	16.72	8.86	6.38	32.14	42.53
Missouri	12.67	13.34	9.29	6.42	30.74	41.72
Nebraska	8.76	12.56	6.25	5.09	24.93	32.62
Mean for twenty States	11.53	12.75	10.55	8.19	28.85	43.02

IS THE RAINFALL INCREASING?

Certain changes have been taking place in Kansas within the the past twenty years which undoubtedly have a tendency to increase the amount of rain. Among these changes, all of which result from the settlement of the State, the following may be mentioned:

First, the plowing of the soil, which is thus enabled to retain a greater proportion of the rain which falls upon it; second, the increase of timber, due to the partial checking of the prairie fires and to the direct influence of settlers in planting trees; and third, the gradual supplanting of the short buffalo grass by the longer and heavier grasses which now prevail in eastern Kansas. It is, however, impossible to present positive proof of the permanent increase of our rainfall, on account of the limited period of observation. The records of at least fifty years would be required to afford a scientific basis for determining this question.

UNIFORM DISTRIBUTION OF RAIN.

Another marked effect of the settlement of a new country would naturally be to secure a more regular distribution of the rain. On this point also, the records are insufficient for positive confirmation. It is, however, the unanimous testimony of the oldest residents of Kansas, that the rainfall is more equally distributed now than ten years ago, coming at shorter intervals and more gently, and that single storms or showers extend over more hours than formerly. My own records at Lawrence show that during the growing season, from March 1st to October 1st, the longest intervals without rain was in the first year of observation, 1868. The rainless intervals for each of the five years were as follow: 1868, seventeen days; 1869, ten days; 1870, eleven days; 1871, eight days; 1872, ten days. From these facts it appears that in neither of the five years was there any approach to a drouth. The number of days on which either rain or snow fell in each year, was as follows: 1868, 77; 1869, 105; 1870, 100; 1871, 120; 1872, 116. This gives an average of 103.6 rainy or snowy days for each year. The average number of such days at Marietta, Ohio, for a period of thirty-two years (1827–1859), was 85.6, and at Brunswick, Maine, for a period of fifty-two years (1807–1859), the corresponding number was ninety-four. (Smithsonian Contributions to Knowledge, vol. xvi.)

SNOW.

Snow is recorded to have fallen as late as April 21st (in 1871), and as early as October 19th (in 1869), but not enough in the former case to whiten the ground. A single fall of snow rarely exceeds

six inches in depth and rarely remains on the ground a week at a time. The heaviest fall of snow was nine inches, which occurred on December 6th, 1868. The following table shows the depth of snow for each month of the five years :

Table VIII.—Depth of Snow in inches for each month, at Lawrence, Kansas, from January 1, 1868. to January 1, 1873.

Year.	Jan.	Feb.	March.	April.	Oct.	Nov.	Dec.	Yearly Amount.
1868	5.00	0.50	0 00	0.00	0.00	6.00	16.00	27.50
1869	4.00	5.25	1.00	1.00	1.25	0.00	5.50	18.00
1870	3.00	0.00	0.00	0.00	0.00	0.00	6.50	9.50
1871	11.00	4.00	4.00	0.00	0.00	5.00	5.75	29.75
1872	1.00	7.75	3.50	0.00	0.00	0.00	11.00	23.25
Mean.....	4.80	3.50	1.70	0.20	0.25	2.20	8.95	21.60

Another important element in climate is the

WIND.

The relative frequency of each of the eight directions of the wind is given in the following table, which embodies 5481 observations. The figures represent the number of times the wind blew from each direction for each year :

Table IX.—Relative Frequency of each Direction of the Wind at Lawrence, from January 1, 1868. to January 1st, 1873.

Year.	N.	S.	E.	W.	N. E.	S. E.	N.W.	S.W.	Calm.
1868	117	228	124	114	92	90	167	141	25
1869	121	243	68	102	95	87	198	126	55
1870	185	325	106	77	56	56	182	71	37
1871	113	225	77	80	72	116	176	193	43
1872	130	255	95	51	88	106	235	116	22
Sums ...	666	1276	470	424	403	455	958	647	182
Times in 1000....	121	233	86	77	74	83	175	118	118

It will be seen from this table that the south winds (including southeast, south, and southwest winds) outnumber the north winds (including northeast, north, and northwest winds) in the ratio of 434 to 370. At Marietta, Ohio, which is in nearly the same latitude as Lawrence, the south winds also prevail, while at Brunswick, Maine, on the contrary, the north winds outnumber the south winds in the ratio of 503 to 417. In regard to the

VELOCITY OF THE WIND,

Our observations extend over the brief period of six months, from July 1st to December 31st, 1872. During this time the anemometer placed on the north dome of the University building registered

64,828 miles as the entire distance traveled by the wind. . This gives an average hourly velocity of nearly fifteen (14.68) miles. The greatest velocity recorded was sixty-five miles an hour from 9 A. M. to 3 P. M. on November 14th. For the sake of comparison it may be mentioned that the mean hourly velocity of the wind at Philadelphia is eleven miles; at Toronto, nine miles; at Plymouth, England, nine miles; at Liverpool, thirteen miles.

FACE OF THE SKY.

The following table gives the average cloudiness in hundredths for each month and year during the period of observation:

Table X.—Mean Cloudiness at Lawrence, Kansas, from January first, 1868, to January first, 1873.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1868	36.13	24.71	51.18	52.00	29.62	41.71	45.96	42.87	46.77	36.31	51.77	49.16	42.35
1869	43.97	51.20	52.81	51.00	46.01	56.74	53.33	45.49	45.44	25.38	62.89	56.56	49.23
1870	49.25	43.69	56.13	49.33	43.87	39.44	30.64	52.80	68.66	54.19	36.83	49.79	47.88
1871	64.00	49.88	52.06	47.11	45.70	46.33	49.79	39.44	34.67	36.77	57.44	45.27	47.37
1872	42.69	54.94	55.06	55.12	55.27	35.33	50.86	33.76	38.33	21.49	44.89	44.30	44.33
Mean..	47.21	44.88	53.45	50.91	44.09	43.91	46.11	42.87	46.77	34.82	50.76	49.02	46.23

It thus appears that on the average a little more than forty-six hundredths of the sky was covered with clouds during the five years of observation. This corroborates the assertion so often made that in Kansas there is a greater proportion of sunny weather than in the Eastern States. In the New England States the average cloudiness is fifty-three hundredths of the sky; in the Southern States forty-seven hundredths; and at Sacramento, California, only thirty-one hundredths; while throughout Great Britain the average reaches seventy hundredths. During our period of observation at Lawrence, the average number of clear days in a year was 157, counting as clear those days on which not more than one-third of the sky was covered with clouds; the average number of half clear days was 89, including under this designation those days on which between one-third and two-thirds of the sky was covered, and the average number of cloudy days was 120, when two-thirds or more were covered. The average number of entirely clear days was 35, and the number of entirely cloudy days was 36.

HUMIDITY OF THE AIR.

The amount of moisture contained in the atmosphere is another important element in climatology. Much has been said in reference to the dryness of the air in Kansas, and on account of this property many invalids have received permanent benefit from a residence in

this State. Our observations on this point are limited to the brief period of two complete years, during which time the average relative humidity was 66.4, complete saturation being represented by 100. By this is meant that upon the average the air contained two-thirds of the amount of moisture it was capable of containing. This percentage of moisture forms a very desirable mean between the very moist and the very dry, being alike favorable to the healthful condition of man, the domestic animals and the growing crops. The relative humidity at Philadelphia is 72, the air containing nearly three-fourths the amount of moisture required for saturation.

I have thus briefly touched upon the most important features of the climate of Kansas, as illustrated by my own observations, trusting that these results may lead to a more accurate knowledge of the subjects involved than is generally possessed by the citizens of Kansas and other States.

Respectfully yours,

FRANK H. SNOW,

Professor of Natural History and Meteorology in the University of Kansas.

GEOLOGY OF THE ARKANSAS.

BY B. F. MUDGE.

This paper is based on observations made in the Arkansas valley at various visits during the past five years, and particularly on a trip recently made as far west as Fort Aubrey, near the Kansas and Colorado line. We confine our remarks to that part between Hutchinson and Fort Aubrey, or that portion covered by the red sandstone of the Cretaceous period.

Observations made the past year confirm the statement in one of my papers read before a former meeting of this Association, viz.: that there is in Kansas no geological representation of the formations found in other countries, between the upper Carboniferous measures or Permian, and the Cretaceous. Careful search has been made for fossils of Jurassic and Triassic periods along the western borders of the Permian, and none have been found, while dicotyledonous leaves and other Cretaceous fossils have lately been procured nearer the line of the Permian than during our first collections.

The Arkansas valley, by its fossils, shows the same peculiarity.

The fossils nearest the Permian are Ostrea congesta and dicotyledonous leaves, two species of the latter, found by us a year ago near Fort Larned, being new to science.

Probably it is well known to this association that the outcrop of nearly all of the coal strata of our State have a strike northeast and southwest, and that they can be followed across the State in those directions. This also applies to all strata of the Cretaceous in the northern half of the State. This rule holds true of the red sandstone of the Cretaceous formation, from the Nebraska line in Washington county to Pawnee Rock in the Arkansas valley, but when reaching this valley the rule ceases.

The average breadth of this sandstone in the northern half of the State is about forty miles (northwest and southeast), or about sixty in a diagonal line running due east and west. But when it reaches the bluffs of the Arkansas valley the strike is westerly, and instead of a westerly extension of sixty miles, it covers the whole country from thirty miles east of Pawnee Rock to the western line of the State, a distance of about two hundred miles. This shows that the ocean which favored the deposit of the upper portion of the Cretaceous, so rich in vertebrate fossils, either did not extend in that direction, or from some local cause was not favorable to such animal life. Had the ocean extended in that direction, but was turbid or deep, too cold or too salt, then no chalk deposit would have taken place. Some one at least of these conditions must have existed for a long period.

The sandstone is much varied in condition and appearance. Near Fort Larned and for seventy miles eastward much of it is of uniform texture and hardness, so that it furnishes a good building material. The buildings of old Forts Zarah, Harker and Larned are constructed of it. Care, however, must be used in selection, as much of it is too soft. Farther west it is more loose in texture, so that for thirty miles on either side of Fort Dodge it is too friable and crumbling to be used in forming culverts and buildings, and the railroad now in construction through this valley has frequently been obliged to transport its stone ten or twelve miles. From Fort Dodge to the western line of the State, a distance of 115 miles, the stone is mixed with some lime in a chalky state, which makes the sandstone still more friable.

The strata are not clearly defined in thickness or extent. In some places, particularly west of Dodge, the deposit varies in a great degree. In some spots it is fine, and in others it is mingled with pebbles of flint, quartz, and other silicious stones of the size of the fist. Instances of oblique stratification often occur, usually of coarse

material, showing that the shores of the old ocean had strong local currents. The whole deposit is so nearly horizontal for two hundred miles, that the inclination of the strata, if any exists, could not be detected. The few finely preserved leaves of land plants which have been found, show the existence of islands in the Cretaceous.

Invertebrate fossils are seen at but few points east of Fort Dodge; but in that vicinity and west of it, they are more frequently found. They are restricted to a few species, mostly represented by ostrea and inoceramus. Fossils of a higher type are extremely rare. During two weeks' search, the only specimen obtained was a single palatal tooth of a fish, Ptychodus.

The character of the materials, uniformity, and level state of the deposition, together with the scarcity of organic remains, renders the geology of this part of Kansas the most monotonous we have ever examined.

Such a formation in any part of the world, has never yet yielded any mineral wealth. I make this statement lest any of our new settlers should waste time and capital in a fruitless search for valuable ores. The red appearance of much of the sandstone is caused by iron. In some places this at first sight would raise the presumption that that metal could be procured in paying quantities. This, however, is not the case. While in the best cases the percentage of iron is low, the quality is quite objectionable. The silicates are so mixed with the metal that only a poor article of iron could be sent to market. I make this statement in the face of an assertion made on our visit that a good iron ore of seventy per cent. had been found near Pawnee Rock. But it is equally the duty of a geologist to tell what geological formations do not produce valuable ores, as to point out good localities.

The soil of a country underlaid by such a deposit would naturally be sandy. To a certain extent this is true of the Arkansas valley, but not so much so as to interfere with a good share of fertility. The higher lime strata of the Cretaceous undoubtedly at a former period covered all this part of the State. The abundant fertile elements of those old limestones are intermingled with the present surface soil, and give to it in most places a fine, rich soil. Consequently this valley, to a very large extent, contains excellent farming lands. On the high prairie the black loam is like that in other parts of Kansas, very rich, and from two to three feet in depth. In the valley the loam is from one to ten feet deep, and more intermingled with sand. From Fort Larned easterly, the valley is more or less cultivated, and the crops compare favorably with

other portions of the State. From that place westwardly, the appearance of the soil continues promising. The portion not fertile is confined almost entirely to the south bank of the river, and consists of a belt of sandy hills covered with coarse grass and bushes, and sprinkled with a few trees. These hills will undoubtedly be turned to profit in raising forest trees, to which they appear well adapted.

The only question to be raised in relation to the settlement of the valley is that of rain. This, however, applies only to the country west of Fort Larned. Thus far there have been no forts or settlement for a length of time sufficient to settle this important question. We found some ponds on the high prairies west of Fort Dodge, but the present season has been one of more than ordinary rainfall.

Like all sandstone countries, the water in the wells is good. In any portion of the bottom (in some places fifteen miles wide) it is found at from six to twenty-five feet from the surface.

The contractors of the Atchison, Topeka & Santa Fe railroad sunk "drive" wells at intervals of two or three miles, and uniformly found good water. In only one instance did we learn of a spring or well of alkali water, and that was a few miles from Fort Aubrey.

The river has a very gentle and uniform descent, according to the railroad surveys, of seven feet to the mile. The entire range between high and low water mark is not over five feet. This, on a river averaging one-third of a mile in width, is most remarkable. In this part of the valley it never overflows its banks. The peculiarities of the river, and uniformity of level in the bottom, renders the valley a favorable situation to try the benefits of irrigation. As this method of farming has not been applied in Kansas, we hope some company will be formed to make the experiment.

WHAT IS GOOD FOR AN ARTIST, AND WHAT AN ARTIST IS GOOD FOR.

BY MISS LIZZIE J. WILLIAMS.

Jabez Stockstill's son, Rubens Rembrandt, wanted to be an artist Jabez did not like the idea; not that he objected to giving him every advantage his own hard-earned money could procure, but he wanted him to be a doctor or a minister — something that would be of some use in the world, and not a mere apology for a man. But Rubens Rembrandt was determined to be a painter, and his father was equally determined that if the boy was one at all he should have every opportunity of becoming a first-class one.

Now, the question was: "What is good for an artist?" He did not wish to give him a thorough collegiate course unless it was going to bear upon his work. He could see how a liberal education could benefit a man in any of the learned professions; but of what use it could be to a painter, or what studies he ought to pursue, he was at a loss to decide. In his perplexity he wrote to one of the deepest thinkers in the land, and was told in reply, since his son had already been sufficiently drilled on the farm, in agriculture, to put him through one of our most thorough colleges, then send him to a theological seminary and medical school; let him take a special course on mechanics and engineering, followed by a year's service in the navy (to gain a familiar acquaintance with the ocean in all its forms); then let him acquire the technical part of his profession at Cooper Institute, or some other academy of design, after which he would be pretty well prepared *to begin* the study of Art, provided he had a common amount of talent and an uncommon amount of perseverance.

Mr. Stockstill was considerably mystified by this reply, but thought he comprehended its meaning, viz.: An artist, of all men, should have the broadest culture — at once the most æsthetic and the most practical, the most profound and the most popular.

Take the studies in the curriculum of any of our best colleges— hardly one that does not bear directly upon his life work. What surgeon needs more than he a careful and exhaustive study of Anatomy, without which it is impossible to draw the human figure correctly. It is now taught in all schools of design; the position and play of each muscle thoroughly understood, as well as the skeleton which underlies them. And what Anatomy is to the Figure Painter,

such is Geology to a Landscape Artist. For all the different varieties of scenery, woods with pleasant avenues, sweet footpaths winding through soft pastures, rivulet and river, nestling village, and pines rearing themselves upon the crests of mountains, may be considered as a garment spread by God's hand from one edge of the horizon to the other, and drooping like the folds of a mantle from a King's shoulders. For all this is merely the drapery of the earth, and it again is sustained and shaped by the rocks, as the muscles are by the bones. Therefore the soil cannot be rightly drawn without a scientific knowledge of the rocks which govern it. Again, if one has any ambition to paint trees, (and in what picture do they not occur?) a knowledge of Botany is indispensable. How many pictures have we seen in which it was not only impossible to tell whether the trees represented were oak, pine, palmetto or crab-apple, but where every law of tree-growth was violated, and the result a huge monstrosity and absurdity, calculated to fill the mind with disgust instead of admiration. Either of these two points might be enlarged upon and have been with absorbing interest, by Ruskin, in volumes four and five of his "Modern Painters."

Who would dare to say he had painted water correctly, without an intimate acquaintance with the laws which govern varied forms? These are best investigated by Natural Philosophy, under Hydraulics and Hydrostatics. "Yes," says our friend Mr. Stockstill, "I *can* see how the sciences which investigate *Nature* bear directly on the subject, but what have your pure Mathematics, and your Greek and Latin got to do with the matter?"

Much, every way. Geometry is involved in all Architectural designs; they cannot be demonstrated without it; and Perspective, as difficult a branch of Mathematics as Conic Sections, comes in at every view in which distance is at all considered. In regard to the Classics, nearly all our higher culture in Art is attained by a study of the Antique. What possible veneration can one have for the masterpieces of Phidias or Praxiteles without an acquaintance with the age in which they lived, their manners, customs, literature, thoughts, religion? The Greek Mythology, the most poetic and fantastic which the world has ever known, was the direct inspiration of the statues and has been handed down to us, still unsurpassed, as models of loveliness and ideals of perfect beauty. Who can behold Raphael's frescoes in the Farnese Palace, of Cupid and Psyche, and appreciate half the exquisite design without understanding the Greek Fable? What meaning would that convey to one unacquainted with the mode of Greek thought? How grasp the delicate,

hidden idea embodied in the statues of the Venus di Medici, the Venus di Milo, (to properly introduce which, Baron Grimm has written so many æsthetic and metaphysical essays,) the Apollo Belvedere, Michael Angelo's "Bacchus," the Farnese Hercules, the Minerva of Phidias, or the writhing agony of Laocoon? It can only be done by placing ourselves as nearly as possible at the Greek standpoint. To accomplish this, *one* method alone remains to us,—a careful study of Greek Literature. The spirit of the age, it seems to me, is making a great mistake in throwing this element of culture out of its practical education; however this may be, to one who aspires to *high* Art such culture is of inestimable value.

We have now completed the curriculum of an ordinary college, and found every department bearing directly toward the end we have in view for our young friend, Rubens Rembrandt. Not that he should complete all these studies before venturing upon the practical; let him cultivate his hand at the same time with his intellec, and taste. Only let him learn through the crayon and brush, facile and ready expression of the ideas these studies have been developing, and he *cannot help* being an Artist. But with all the heir-ship of genius Nature has bestowed as a birth-right, and all the mechanical dexterity attained by patient practice, without these mental acquisitions he will never become an artist, but will forever remain a mere Artisan.

Further, Mr. Stockstill's adviser said that having completed a collegiate course it would be of advantage to Rubens Rembrandt to study Divinity. Doctrinal Theology, perhaps not; (it is a question whether it is an advantage to our clergymen;) but a close study of the life and teachings of Christ, emphatically, *yes*. Nearly all of the great Artists have modeled their lives after His. What more lovely than the sweet, calm enthusiasm of the cloistered life of Fra Angelico. a saint as truly inspired as the Apostle John; for each in his cloistered life saw the heavens opened, and left behind him records of his beatific visions. What more grandly sublime than the unapproachably heroic, and self-sacrificing life of Michael Angelo? Steadfast, unmovable, strong to endure, mighty in power, misunderstood and solitary save when "an angel was sent to strengthen him." An Artist's sympathy with his race must be broad, out-reaching like that of his Master's. If he could catch the most delicate expressions of feeling, and transfer them to canvas accurately, he must be "a partaker of the Divine Nature,"an apt scholar of the Great Teacher. True there have been Artists of dissolute lives; their works show it; but all these "died young, or painted ill when old."

Our sensible, practical friend, Mr. Stockstill, asks another question: "What is an artist good for?"

After I have given Rubens Rembrandt the expensive education you advise, and the advantage of Art-school besides, of what earthly use will he be in a busy, work-a-day world like this? Will he be an ornamental superfluity, only fit to talk "tone, old masters, the Renaissance and pre-Raphaelitism" in the drawing-room, or a wild enthusiast who never combs his hair, and taking a great white umbrella, plants himself in some waste and solitary place, daubs furiously canvases which unpainted cost $2.50, and painted cannot be sold for twenty-five cents? Nothing of the sort. After leaving the halls of his Alma Mater he will be ready and proud to step into a carpenter's shop, and having served a short apprenticeship at the bench, a new sign will appear on one of the streets of your village, R. R. Stockstill, Architect and Builder, and that town will owe more to you in the gothic arches of its churches, its commodious school houses, imposing court house, elegant music hall, palatial villas and exquisite gems of cottages,—a thousandfold more to you, sir, or to the education you have given your son, than if you had invested the money it cost you in city bonds and burned them on the spot.

Or he may become an inventor of machinery, and by some lucky patent make all your fortunes. Or he may become a Bridge Builder, or a Designer, and of this class the name is legion. I will enumerate only a few of the different departments, in each of which there is a steady demand for designers of cultivated artistic tastes. First, Engravers and chasers in gold and silver. A lady in Philadelphia has laid by a snug little fortune by chasing the backs of gold watches. She easily earned $1 per hour. It is light work, but requires skill in drawing. There are but few first-class engravers, and the demand for engraved jewelry and silverware is on the increase.

Another branch of the same business is that of the lapidary and cameo-cutter. There are two kinds of cameo-cutting—one with a lapidary's wheel of hard stones, as the onyx and the sardonyx; but the more common are the shell-cameos, which are cut with small steel chisels from the white portion of the shell, leaving the chocolate color for the back ground. In Mrs. Lee's "Sculpture and Sculptors," we find an account of those who have engaged in cameo-cutting in the United States. Then we have ivory cutters and pearl-workers, and workers in the Intaglio and Mosaic. "A great deal of money is expended on monuments, but there is a lack of variety in the designs," and marble, under any circumstances, is a noble field for the artist.

Plaster statuary, we are told from reliable authority, gives lucrative employment in our large cities, to those who are adept in geometrical figures and drawing. Inventive talent finds a ready field for exercise, while the study of architectural ornaments and books is a great advantage to an expert with a pencil. Designers are employed in all glass companies, in carpet factories and calico mills. In these departments a person of lively fancy and nice powers of discrimination succeeds best. Gay, rich, dark colors are not suitable for summer, nor light, delicate shades for winter. Designers of quick perception originate the most tasteful dress goods. In the Report of the Philadelphia School of Design it is stated that one of the ladies of that school received $60 for a design for wall-paper; they seldom bring so much, however, the usual price being from $12 to $20. This is almost entirely monopolized by the French. One leading manufactory gets its patterns from the School of Design in Paris, and another New York firm pays a Frenchman $1,000 a year, the same man receiving $3,000 per annum for designing in another manufactory.

China decorators and porcelain painters are finding employment in the United States, though for want of cultivated and imaginative designers the European work still excels in beauty and elegance. The porcelain of Japan is most durable, that of France most ornamental. The delicate lace-work in Dresden china is executed by women. In all these departments the demand is not so much for mere mechanical skill as for highly cultivated ideas and refined tastes that give back their own image; as "Nature is the glass reflecting God."

Fresco painting is becoming a steady employment in our larger cities, and requires a wide range of culture, as well as a vivid conception for the artist to become eminent in the profession. Landscape gardeners are loudly called for. These can only distinguish themselves by being in harmony with nature and diversity of climate —a field as vast as the globe, embracing a knowledge of both vegetable and animal kingdom, without which most egregious blunders will occur. Mr. Demas "Ignoramus" paid a fabulous sum for one of God's master-pieces on College Hill, Cincinnati. The creator had terraced its slopes with His own hand, planted the red-bud and hung the scarlet bitter-sweet, which are unsurpassed in beauty in Ohio. Nothing was wanting, save a few statues of native, wild animals artistically interspersed, to keep the landscape intact. What does the barbarian do, but order his gardener (a man of far more culture than himself) to cut down his most valuable trees and fill up the ravine to a dead level.

Lithographers, steel engravers, copper-plate engravers, map engravers, bank-note engravers, card engravers, seal engravers, and so forth ad infinitum, are in constant demand. The Director of the Pennsylvania Academy of Fine Arts says: "*Skill* in drawing is a key that admits to a wider range of art than I can readily enumerate, and successful and profitable employment in engraving depends on *that*." Further, he says that "Whatever branch of the Fine Arts is to be followed, there are three requisites. The first is drawing, the second is *drawing*, and the third is DRAWING." In short, the industrial appliances of art are almost innumerable. The occupation into which it does not enter to some extent is an exception. Take a very simple example. Color-blindness is a more common misfortune than ordinarily supposed. The colors generally confused are green and red; yet these are the very ones used as railroad signals. So that a great railroad catastrophe may be the result of a locomotive engineer not having "an eye for color."

It is little estimated how much Art has to do with the politics of the day. The Tammany Ring owes the contempt now felt for its corruption principally to Nast's caricatures of Tweed, Sweeny, and others.

Mr. Greeley's defeat was in a great measure owing to the comic pages of the illustrated newspapers.

This power of caricature may be more fully appreciated by a study of the Masters in this department.

Cruikshank, the accepted portrayer of Dickens's characters—Gustavus Dore, is unrivaled here. Chane, the author of the comicalities in Le Mode Illustri, is intensely humorous, while nothing can equal the delicate *wit* of Paul Kanewka's Silhouettes. The artist who takes off society life for Punch is irresistible.

The close connection that exists between Art and Literature is shown by the fact that so many authors illustrate their own works. Hood did so, and Thackeray is almost as noted an artist as an author. It would be hard to tell in which department to class Ruskin. Indeed, the same qualities and the same culture are required for each; both must be keen observers and highly imaginative. Take a dirty roadside pond as an example. An ordinary man knows that it is muddy and sees nothing but mud, and would express it on canvas by a great brown daub.

"A great painter sees beneath and behind the brown surface what will take him a day's work to follow, and he follows it, cost what it will. He sees it is not the dull, dirty, blank thing which he supposes it to be; it has a heart as well as ourselves, and in the bottom of

that there are the boughs of the tall trees and their quivering leaves, and all the hazy passages of sunshine, the blades of the shaking grass with all manner of hues of variable, pleasant light out of the sky; and the bottom seen in the clear little bits at the edge, and the stones of it, and all the sky, and the clouds far down in the middle drawn as completely and more delicately they must be than the real clouds above. For the ugly gutter that stagnates over the drain-bars in the heart of the foul city, is not altogether base; down in that if you will look deep enough you may see the dark, serious blue of the far off sky and the passing of pure clouds. It is at your will that you see in that despised stream either the refuse of the street, or the image of the sky; so it is with many other things we unkindly despise." A painter who is a nice observer enough to notice all this, will be equally exact and discriminating in all his observations; ten to one he will be as ready in giving you a verbal account of them, as in a pictured one. Ergo, a good Artist should be an entertaining writer and an eloquent orator. Indeed, I can think of nothing with the exception of religion, as remarkable as Art for its universal adaptability, its all-preserving character. To the poor a means of support and source of rich enjoyment. To the scholar opening fields of critical study and connoisseurship, cultivating the tastes of the rich, so that their wealth is not mere vulgar display, but made the patron of luxury, which is æsthetic, and elegance which is the perfection of loveliness.

If, like religion, it enters into all our humdrum cares, beautifying our homes and glorifying the humblest occupation, what then must be the happiness of one allowed to minister as priest in the Holy of Holies, and leaving the application, devote himself exclusively to High Art? I maintain there is but one vocation equal in beauty, in honor and sacredness, to that of the Artist. That *one* is the Christian Ministry. Men there are who disgrace both callings; it seems to me to be worthy of either, a man should devote his life to the work, and be filled with such a holy passion, such a calm but overmastering enthusiasm that nothing earthly—fame, friends, fortune, happiness, applause, high honor, even love—these, or the loss of any or all of them should materially affect him. Nay, he should be able to say with the Apostle Paul, "I am persuaded that neither death, nor life, nor angels, nor principalities, nor powers, nor things present, nor things to come, nor height, nor depth, nor any other creature, shall be able to separate me from the love of God as manifested in my most sacred calling."

Only an amateur as yet, standing as a novice at the outer gate, it

is my high ambition some day to serve within thy temple, O Art! and to add imperfect and faulty, but loving, work to that of the noble army of Artists who still praise thee.

AGRICULTURAL COLLEGE, MANHATTAN, KAN., October, 1872.

METEOROLOGICAL SUMMARY FOR THE YEAR 1872.

By Prof. F. H. Snow, of the Lawrence State University.

Station, Lawrence, Kansas. Latitude 38° 58′; longitude 95° 16′. Elevation of the barometer and thermometers, 884 feet above sea level and 14 feet above the ground; rain gauge on the ground; anemometer 105 feet above the ground, on the dome of the University building.

TEMPERATURE.

Mean temperature of the year, 51.90°, which is 1.23° lower than the mean temperature of the four preceding years. Mean temperature of the winter months, 24.91°; of the spring, 53.21°; of the summer, 70.40°; of the autumn, 51.91°. The winter and spring were each four degrees colder, and the summer and autumn were each less than half a degree cooler than the corresponding seasons in the year 1871.

The mean temperature of the year 1869 was 1.54° lower than that of 1872, but in the former year the winter months were much warmer. and the summer much cooler than in the year just completed.

The mean temperature at 7 A. M., 44.89°; at 2 P. M., 61.14°; at 9 P. M., 94.65°. The highest temperature was 97°, June 26 and August 26; the lowest, 18° below zero, December 20 and 24—giving a range of 115° for the year. The mercury fell below zero on 16 days, January 28, 29, 30 and 31, February 3, 6 and 7, November 29, and December 20 to 27, inclusive. The "cold snap" in December was the severest and longest continued on our record, the mercury on one occasion remaining below zero for 50 consecutive hours. The month of November was even colder than in 1871, the mercury sinking below zero for the first time on record for that month. Winter weather began November 13th, five days earlier than last year, and the Kansas river was closed on the 29th, two days later than last year. The coldest month of the year was December, with mean temperature of 19.93°; the coldest week was in December, (20th to 26th, inclusive,) the mean temperature being only one-twentieth of a degree above

zero, which is 7.91° colder than any previous week recorded; the coldest day was December 24th, the mean temperature being 9° below zero. The 21st, 23d and 24th of December were each colder than the coldest of previous years.

The hottest month was July, mean temperature 77.96°; the hottest week was in August (21st to 27th inclusive), mean temperature 83°; the hottest day was June 26th, mean temperature 85.7°. During the year there were forty-five days on which the mercury reached or exceeded 90°, viz.: Fourteen in June, eleven in July, thirteen in August, five in September, and two in October. The last light frost of spring was April 22d; the first light frost of autumn was September 27th, making the period of entire absence of frost 158 days. It is remarkable that this period is precisely the same, and with the same dates of beginning and ending, as in 1871. The last severe frost of spring was April 1st; the first severe frost of autumn was October 10th, making the interval of absence of severe frost 192 days. No spring or autumn frost did any damage to fruit. The extreme cold of December, however, has undoubtedly killed the peach buds in most localities.

RAIN.

The whole amount of rain, including melted snow, 32.63 inches, which is 2.50 inches less than the average rainfall of the four preceding years. During the year there were 116 days on which either rain or snow fell, a larger number than in any previous year of our record. The longest interval without rain in the growing season, from March 1st to October 1st, was ten days. The number of thunder showers during the year was forty, a greater number than in either of the four preceding years.

SNOW.

The entire depth of snow was 23¼ inches, distributed as follows: January, 1 inch; February, 7¾ inches; March, 3½ inches; December, 11 inches. The last snow flurry of spring was March 24th; the first autumn snow was November 14th, not enough to whiten the ground on the latter date. Snow fell on twenty-five days—four days less than in 1871. The entire amount of snow, as given above, is 6½ inches less than fell in 1871, which was the snowiest year of our record. The average annual snow fall for the five years just completed is 21.6 inches, the least amount being in 1870—9½ inches.

FACE OF THE SKY.

Average cloudiness of the year, 44.28 per cent. of the sky, more than 3 per cent. less than in 1871. The number of clear days in the

year was 168, counting those days clear on which the average cloudiness did not exceed one-third of the sky; the number of half clear days was 93, including under this designation, those days on which between one-third and two-thirds of the sky was covered with clouds; the number of cloudy days was 105, when two-thirds or more was covered. There were thirty-four entirely clear days, without a trace of a cloud; there were only twenty-three entirely cloudy days, without a trace of sky. May was the cloudiest month, when the average cloudiness was 55.27 per cent.; October was the clearest month — the clearest in five years — only 21.40 per cent. of the sky being clouded. The mean cloudiness at 7 A. M. was 47.79 per cent.; at 2 P. M., 48.06 per cent.; at 9 P. M., 36.99 per cent.

WIND.

During the year (three observations daily), the wind was from the south 255 times, northwest 235 times, north 130 times, southwest 116 times, southeast 106 times, east 95 times, northeast 88 times, west 51 times, calm 22 times.

It will be seen that the south winds (including southwest, south and southeast), outnumbered the north winds (including northwest, north and northeast), in ratio of 477 to 453. This preponderance of the south winds has existed in each of our five years of observation. In New England, the north winds largely outnumber the south winds.

Observations upon the velocity of the wind were made during the second half of the year. During the six months, the anemometer on the north dome of the University building, registered 64,828 miles as the entire distance traveled by the wind. This gives an average hourly velocity of 14.68 miles. The average at Philadelphia is 13 miles an hour.

The highest velocity during the six months was 60 miles an hour, from 9 A. M. to 3 P. M., November 14th, on which day the wind traveled 1,050 miles.

BAROMETER.

Mean height of barometer column, 29.112 inches. Mean at 7 A. M., 29.137 inches; at 2 P. M., 29.089 inches; at 9 P. M., 29.111 inches. Maximum height, 29.779 inches, at 9 P. M., November 28; minimum, 28.401 inches, at 2 P. M., April 6; range for the year, 1.378 inches. The highest monthly mean was in December, 29.299 inches; the lowest was in April, 28.999 inches.

RELATIVE HUMIDITY.

Mean for the year, 64.4, that is, the air contained on the average, less than two-thirds the amount of moisture necessary for saturation,

this being a very healthful mean. The mean at 7 A. M. was 75.49; at 2 P. M., 46.72; at 9 P. M., 71.08. There were eleven fogs during the year. October was the dryest month—humidity 53.69; July was the dampest month—humidity 75.2. The least amount of atmospheric moisture observed was at 2 P. M., April 12th, when the relative humidity was only 9.2, less than one-tenth of saturation.

The following table gives the mean temperature, the extremes of temperature and the rainfall for each month of the year 1872 :

Month.	Mean Temperature.	Max'm Temperature.	Min'm Temperature.	Rainfall in Inches.
January	24.35	50.5	—7.5	0.17
February	30.44	61.0	—12.0	0.82
March	37.23	72.0	18.0	2.92
April	56.42	85.0	30.0	4.74
May	65.98	88.0	39.0	5.72
June	76.98	97.0	53.0	1.30
July	77.96	93.5	61.5	6.50
August	77.27	97.0	53.0	4.71
September	66.73	94.0	37 0	2.55
October	55.64	92.0	27.0	1.95
November	33.36	67.0	—1.0	0.01
December	19.93	58.5	—18.0	1.24
Year 1872	*51.90	97.0	—18.0	32.63
Year 1871	54.30	103.0	—6.0	33.23
Year 1870	54.50	102.0	—10.0	31.32
Year 1869	50.36	96.0	—5.0	38.51
Year 1868	53.36	101.0	—16.5	37.48

*The yearly means are not found by dividing the monthly means by twelve, which would be correct if the number of days in each month were the same; but by dividing the sum of all the observations by the actual number of observations (in this case 1,098).

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